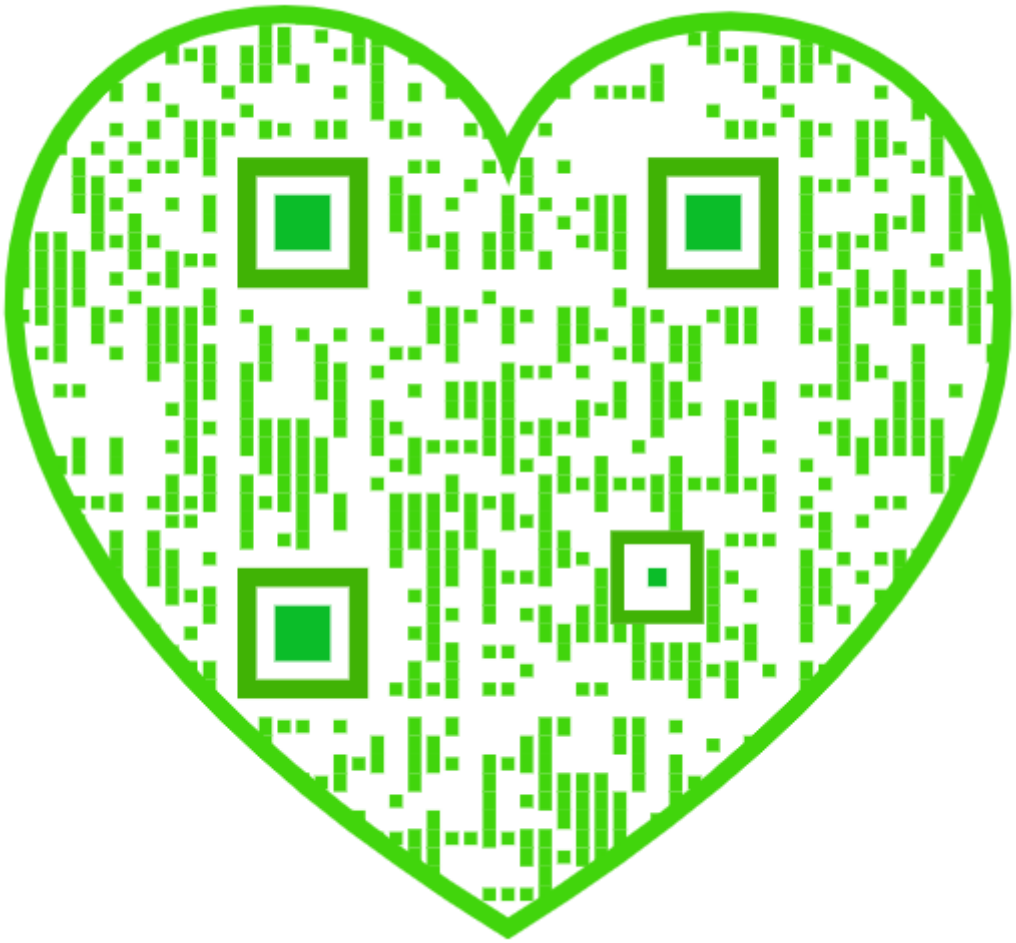
THE BEE-KEEPER'S MANUAL

BY HENRY TAYLOR

REVISED BY
ALFRED WATTS



THE BEE-KEEPER'S MANUAL.

THE

BEE-KEEPER'S MANUAL

OR

THE HONEY BEE

ITS

MANAGEMENT AND PRESERVATION.

WITH A

DESCRIPTION OF THE BEST APPROVED HIVES, AND OTHER APPLIANCES OF THE APIARY.

BY THE LATE

HENRY TAYLOR.

Seventh Edition.

MODERNISED AND VERY GREATLY ENLARGED

BY

ALFRED WATTS,

Assistant Editor of the Third Edition of Neighbour's "Apiary."

LONDON:

GROOMBRIDGE AND SONS.

MDCCCLXXX.

E 1181

What well-appointed commonwealths ! where each
  Adds to the stock of happiness for all ;
Wisdom's own forums ! where professors teach
  Eloquent lessons in their vaulted hall :
Galleries of art, and schools of industry !
  Stores of rich fragrance ! Orchestras of song !
What marvellous seats of hidden alchemy !
  How oft, when wandering far and erring long,
Man might learn truth and virtue from the bee !

BOWRING.

SIMSON AND CO., PRINTERS, ETC., HERTFORD.

PREFACE

TO THE

SEVENTH EDITION.

SEVERAL years have now elapsed since the last issue of this volume appeared, and for some time its author has been taken from among us. Through six editions his revising oversight was extended to the work; and now, when at length it has been determined to reissue it under other care, the entire aspect of the subject treated of is changed. Important facts have been promulgated in the interval, which, in this country at least, had been hitherto unknown, and novel apparatus and improved methods of procedure have taken the place of those of Taylor's day. To express this revolution with faithfulness in the following pages, it has been necessary for a very large portion of them to be composed of absolutely fresh matter. Others, and in fact nearly all, have been more or less extensively interpolated and revised, and altogether the present edition of the Manual has in three-fifths of its contents become a new book.

To turn from the general to the particular, the vast and valuable additions to our scientific knowledge that have resulted from half a century of German investigations have been extensively utilised in the revision of those sections which deal with the natural history of the bee. In nearly every page old errors have been rectified, or newly-ascertained facts given insertion; whilst the marvellous reproductive economy of the insect has now for the first time received notice in the work. The importation of the Italian variety has provided occasion for another additional section, and in fine this first portion of the volume has grown from the twenty small pages of the sixth edition to the forty-five enlarged ones which are presented to the reader now.

The introduction of frame hives, with all their train of concomitant improvements, has compelled the sections devoted to hives and apparatus to undergo a renovation no whit less complete. The department of manipulation has been subjected to one but little less sweeping, and quite a number of totally fresh sections will be found to be now comprised therein. The disquieting subject of Foul Brood, to which Mr. Taylor did not so much as offer allusion, is now fully set forth, both in its past and present aspects, by means of information from Von Berlepsch and Schönfeld, which may perhaps prove of interest to other apiculturists besides

those first beginners whom a manual has principally in view.

In the carrying out of these extensive transformations the editor has kept two distinct aims before him—to modernise everything that was really out of date, and yet to retain every possible vestige of the individuality of Mr. Henry Taylor. The adherence to these sometimes conflicting lines of procedure has necessarily caused the book to exhibit some literary irregularities, particularly where the "I" of the original author is followed somewhat closely by the "we" of his reviser. But it was felt that blemishes like these would be readily pardoned by the reader as a preferable alternative to sacrificing the only evidence of the presence of Mr. Taylor's own hand. There are a host of remarks and recommendations which are essentially his own, and in which it will be a satisfaction to the reader to know from whom they proceed, and not less so to the editor to feel that they are so known.

More especially is the means to this distinction felt desirable, as the editor most expressly disclaims the slightest idea of erecting himself into an authority. In a literary and not a practical sense consists his connection with the book, and when he takes upon him to correct a master of the standing of Henry Taylor, he does it distinctly and exclusively in reliance upon the statements of others equally esteemed. And thus, he ventures to

hope, on sending forth this second apiarian work which within three years he has made largely his own, that the accumulations herein from the studies and labours of others may have made of this volume a useful and trustworthy guide. More than this it would ill become him to assert, but if he has accomplished less than this it has at any rate not happened from lack of adequate pains.

The first, though very far from the only source of his emendations, has very naturally been the volume on which his earlier labours were engaged. The additions made thereto by himself—comprising a large part of what is valuable in Von Berlepsch and Langstroth—as well as the materials gathered by Mr. Alfred Neighbour, have been freely rendered available for the present purpose, though never to the extent of even quoting his own words without acknowledgment. Besides this, there have been extensive researches made afresh in German authorities; other aid has been found in Mr. Shirley Hibberd's "Rustic Adornments," and in several English periodicals; and, lastly, there have been the invaluable communications of the Rev. F. R. Cheshire and T. W. Cowan, Esq. The assistance rendered by both these gentlemen, though never involving their responsibility for a single statement not expressly cited as from them, has imparted an appreciable degree of accuracy and completeness to the treatment of more than one subject herein, and, both

in the publishers' name and his own, the editor has here to express to the said gentlemen his most hearty thanks, both for the services themselves and the courtesy with which they were uniformly given. To Mr. Cheshire's unique volume of instructions upon the practice of apiculture, a special fund of obligations must be acknowledged, and this may perhaps be most emphatically conveyed by stating the indispensability of the "Practical Bee-keeping" to every one who aspires to become a master of manipulation.

To Messrs. Neighbour and Sons of Regent Street and Mr. James Lee of Bagshot, as well as to Mr. S. Simmins of Crawley and the proprietary of the "Country" newspaper, further indebtedness, more or less extensive, must be expressed for the loan of a number of blocks for illustrations, the absence of which would have entailed either a sad deficiency in the value of this work, or else a large addition to the cost of its production. Doubtless it would have been found that many other manufacturers would gladly have rendered similar aid, but it was felt that, with the exception of one or two specialities, it was better to restrict the selection to the two houses universally admitted to be pre-eminent. A mistake, however, was confessedly made at the outset in imagining that a certain third house stood almost on a level with the two; but a rebuff was received from the ruling authority, and one or two facts which have since transpired have caused a

revulsion of opinion as complete as that in the famous case of the fox and the grapes.

One more word of egotism and the editor may make his bow. The single claim which he has advanced to any qualification for treating upon this subject rests upon his connection with the new edition of Neighbour's "Apiary;" but as it was concluded to make no pointed mention of his name in that work, it seems only due to his present readers to notify that, besides entirely recasting that volume, he compiled and wrote the greater portion of its new matter, or about one-third of the total contents as they stand. The frequent and favourable allusion to Messrs. Neighbour in the present work will, it is hoped, without giving it even the suspicion of being issued in the trade interest of their firm, yet show clearly that there is no unfriendly rivalry between the two publications, but that both editor and publishers desire to reciprocate to the full the kindly services which they have themselves received.

A. W.

Twickenham, *June, 1880.*

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THE

BEE-KEEPER'S MANUAL.

INTRODUCTORY NOTICES.

The Hive or domestic Honey Bee of this country is classed entomologically *Apis mellifica*, order *Hymenoptera*, or membrane-winged* insects; it comprises the bees, wasps, ants, and some others. Great numbers of species of wild bees are known, and about 250 are natives of our islands; but even of the honey-bee proper there are now several kinds kept for domestic purposes. Of these the principal, besides our own, is the elegant Italian or Ligurian bee, which, though sometimes classed as *Apis ligustica*, is generally allowed to be only a variety of the common honey-bee, possessing no clear mark for a specific distinction, and varying through the widest range in respect of its differences in external colouring. A still handsomer bee is the Egyptian, and this is probably with correctness reckoned as a distinct

* Such (and not "wedded upon the wing" as might perhaps have been supposed) is the meaning of the word, though the characteristic is by no means peculiar to this order. But "having *four* wings," which Mr. Taylor gave as its distinctive feature, is one that is common to no less than six out of the twelve of Cuvier's orders of *Insecta*.

species under the name of *Apis fasciata;* but both it, and the six or eight other kinds occasionally spoken of, are at present little more than curiosities of the fancier. The Italian, on the contrary, is now cultivated in nearly every apiary, and we shall therefore make further mention of it in a subsequent section; giving also the briefest possible notice of such of the others as have at present fallen under our observation.

The limits to which a bee-keeper's manual of practice is necessarily confined, permit only the remark that these extraordinary insects are, as to origin and history, lost in the mists of a remote antiquity. We know, however, that they, their habits and productions, are alluded to in Scripture, and attracted marked attention and admiration in the early eastern communities, where doubtless was familiar their characteristic Oriental name, *Deburah*—"she that speaketh." Subsequently the bee has spread itself, or been carried, in spite of clime and temperature, over a large portion of the old continents; following in the wake of civilised man wherever he has placed his foot in the primeval forests of the new world; and later on, in our own time, has been received as a friend and benefactor in the boundless regions of Australasia and the islands of the Pacific Ocean. From the time of Aristotle down to our own day, treatises on bees have ever been popular, and the curious naturalist has no difficulty in collecting a library relative to a subject apparently inexhaustible. But space allows us to notice neither the crude speculations to be met with in ancient

literature, the unprofitable disputations too often prevailing among modern bee-annalists, nor the endless catalogue of hives, possible and impossible, of every period, by which the novice is bewildered. Our present purpose is restricted to a utilitarian view of the subject of apiarian knowledge, where science, invention, and the most competent testimony, have combined to place it in our own day.

The following facts in connection with the literature of the subject ought however to be known to every bee-keeper. From the seventeenth century downwards, this insect has found able observers in the persons especially of Swammerdam of Holland, Maraldi of Italy, Réaumur of France, Schirach of Saxony, Dr. Hunter of England, and Bonnet and Huber of Switzerland. The last-mentioned of these is at the same time the most famous and the most extraordinary, for though totally blind, he succeeded, by the help principally of his assistant Burnens, in bringing to light such marvellous facts that the entire theory of bee-life underwent a revolution. In our own day the science has again made gigantic strides, and this time as the result of German research. A second revolution, in the same direction as the first, has in fact resulted from the observations of Dr. Dzierzon, a Roman Catholic priest of Prussian Silesia; while to three or four other Germans, especially the late Baron von Berlepsch, we are also indebted for discoveries of the highest value. The name of the Rev. L. L. Langstroth of Ohio must be added as that of the most esteemed of living writers whom our own tongue can number among its apiarian authorities.

To those who may be unacquainted with the leading characteristic of the honey-bee, it is necessary to premise that in every family, when fully constituted, its members are of three kinds of individuals ; viz.,

A *Queen*, or *Mother Bee*,

The *Common*, or *Working Bees ;*

And (during a part of the year) the *Male*, or *Drone Bees.*

Thus associated, they severally perform their allotted functions in great harmony, labouring for the general good, combining in self-defence, recognising one another, but permitting, as a rule, the intrusion of no stranger within the hive.

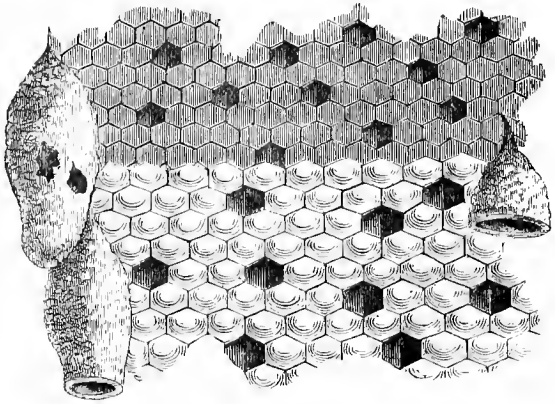
THE QUEEN OR MOTHER BEE

Is darker on the back, longer, and more taper towards the end of her body than the common bees ; has

longer legs but shorter wings, and is of a tawny or yellowish-brown colour underneath. She is further distinguished from the workers by having a somewhat rounder head, a smaller proboscis, and legs destitute of brushes or deposit-baskets; also by a honey-like scent. She is supreme in the hive, admitting no rival or equal; and is armed with a sting, somewhat more curved in form than that of the common bees, which, however, she rarely uses. Where she goes the other bees follow; and so indispensable is her presence to the existence of the commonwealth, that where she is not, none will long remain. She is the mother of the entire community, her office being to lay the eggs from which all proceed, whether future queens, drones, or workers. Separate her from the family, and she instinctively resents the injury, refuses food, pines, and dies. Without a queen, or a prospect of one, the labour of the hive is suspended, and a gradual dispersion or emigration of the community ensues.

Those who have examined the appearance of a beehive after it has been filled with combs during a year, will recollect seeing suspended here and there certain small inverted cup-shaped forms. These are the partially destroyed remains of what have constituted or been designed for the birth-places of young queens, and are commonly called royal cells. They are very much larger than the common hexagonal cells in which the working bees are bred; and they further vary in their composition, the material of which appears to be a mixture of wax or propolis and the farina of flowers.

Soon after the foundation of one of them has been laid, an egg is deposited in it,* the work



of completion of the cradle being carried on as required by the increasing growth of its occupant. When finished and closed up, it presents in form the appearance of an oblong spheroid, about an inch long, usually appended like a stalactite per-

* Considering the antipathy of queens to their rivals, it has long been supposed that they never themselves lay eggs in royal cells, but that the workers remove them thereinto from worker cells. Instances of both acts may occur, and yet neither give a rule. Von Berlepsch ascribes it to the queen herself (and certainly other facts show that her antipathy is not developed till an advanced stage of her rival's existence); he further doubts the possibility of an egg when once laid being removed from its original spot, unless by accidental adherence to a bee's body before its glutinous coating has rendered it a fixture. Mrs. E. S. Tupper, however, cites an instance of such removal which seems hard to dispute, and Mr. Cheshire and others have noted similar ones. But very often, we know, the cell was a *worker* cell when the egg was deposited by the queen, and was not till *afterwards* transformed into a royal one. This indeed may be accepted as the general rule, but the whole subject requires further investigation.

pendicularly to the edge of a comb, the small end or mouth being downwards, a position most favourable to economy of space in the hive. In number the royal cells vary from four or five to a dozen, and sometimes more. They are not commenced till after the usual great spring laying of eggs for the production of working bees, preparatory to swarming; as well as of those to produce drone bees. The existence of the latter, in some stage of development, is an invariable preliminary to the construction of royal cells, the reason for which will hereafter appear. The affectionate attachment evinced by the nurse-bees towards the royal larvæ is marvellous, and the quantity of food given is profuse. They arrive severally at maturity on or about the sixteenth day from the laying of each egg; these having usually an interval between them of but a few days. Of the young females, or princesses as they are often called, and the mode of disposing of supernumerary ones, we shall speak more at large when we come to treat of swarming.

The duration of life in a queen bee, under ordinary circumstances, is, by a wise provision for the perpetuation of the species, much more prolonged than is the case with the common bees, and has been satisfactorily ascertained to extend sometimes to a term of five years; four years is set down by Dzierzon as the average. I am, however, inclined to believe that changes of queens take place oftener than we are aware of, for in nothing in nature is there displayed a more careful attention to the due preservation of a family of bees than in the

provision made for supplying the casual vacancies arising not merely from the natural demise of the sovereign, but from other causes, especially those involving deficient powers or absolute sterility. I should therefore discountenance any attempt at direct interference by the forcible removal of a queen, after a prescribed period, as has sometimes been advocated.* If, however, it should happen that such removal is absolutely necessary, the bees will accept a successor as soon as they have discovered their loss, which is often not till after the lapse of several hours. If all is right the previous agitation will cease.

And this leads us on to a curious, if not unique, fact in relation to the natural history of the honey-bee, which, though probably not unknown to the ancients, was re-discovered and promulgated by Schirach, a member of an apiarian society formed in the middle of the last century at Little Dautzen, in Upper Lusatia. In contradistinction to the usual way in which a young queen is created, preparatory to the swarming season, by what is denominated the *natural* process, the details which we are about to give show that the same thing may be effected by another mode, or, as it is said, *artificially*. Whether these terms, as opposed to each other, are rightly applied or not, they at least mark a difference; and being thus practically understood, we shall follow

* The editor has left this recommendation of Mr. Taylor's unaltered, though doubting whether he would express himself just in the same way at the present date. Still a fair deduction from the entire passage is—Don't remove the queen merely because she is three years old, but *do so* if she exhibits a falling-off in her laying powers.

the example of other authors in using them. The fact itself, startling as at first it seemed, has been so clearly authenticated that any lurking scepticism has disappeared; and, indeed, the principle is now so well understood and carried into general use by the scientific apiculturist that, in a popular treatise on the honey-bee, our object would be imperfectly accomplished without entering into a few particulars in connection with it. And first, we have the assurance that the prevalent opinion as to any supposed original or generated difference between common eggs and those laid for the especial production of queen bees, is founded in error; an altered and accelerated mode as to the development of the egg being all that is needed for the maturation of a perfect female. That we may understand the method of procedure on the part of the bees, we have to suppose that a hive has been deprived of its queen (no matter whether by death or design) at a period when eggs or larvæ, or both, are present in the cells: such larvæ, to answer the purpose, being not more than two or three days old, for this is essential. Could we at such a juncture witness the proceedings of the family, a spectacle would be presented of much domestic distress and confusion when it had been discovered that the hive was queenless. Soon, however, the scene changes to the quietude of hope, for the foundation of a queen's cell (and, as a provision against possible failure, often of three or four) is commenced by the bees, usually within twenty-four hours. They select a worker egg, or else a grub

or larva not exceeding the age just specified, and enlarge the cell it occupies by sacrificing three of the contiguous ones, surrounding it with a cylindrical enclosure; the new cradle of royalty presenting in this stage the appearance of an acorn cup. The embryo princess, for such she has now become, is amply supplied with a nurture known as "royal jelly," which consists of a mixture of honey with pollen that has undergone partial digestion in the bodies of the nurses; her habitation in the meanwhile receiving elongation to suit her growth. About the fifth day the worm assumes the nymph state, the cell being now worked into its usual pear-shaped figure; the bees quitting it as soon as the lower end is finally closed. About the sixteenth day a perfectly developed female comes forth, in no respect differing from a queen bred in the natural way. Fecundation and the laying of eggs usually follow in a few days, the economy of the hive then resuming its wonted course. But should the loss of the queen happen at a season when the hive is without any worker brood, the whole colony must in time die off, unless a new queen is introduced by the bee-keeper.

The queen bee rarely* leaves home, or is to be seen, except in hives constructed purposely with a view to observation. In such a one I have frequently watched the proceedings, as she has leisurely traversed

* It should rather be said *never*, except when in the first few days or weeks of her life she sallies forth in quest of a mate. When this object has been once accomplished, she remains impregnated either for her entire existence or until hopelessly superannuated. Of course the occasion of swarming will furnish another exception.

the combs, the bees clearing a passage on her approach, their heads turned towards her, and, by repeatedly touching her with their antennæ, showing what appears to be a marked attachment—a favour she is occasionally seen to return. Indeed, in some well-authenticated instances, the signs of affection have been continued even after her death. The precise character of this feeling is now, however, regarded in a very different light from what it formerly was, for it is plainly the mere loyalty of a subject rather than the personal love of a child. But even this view is only partially the correct one, and to fully realise its nature we must take into account the intense *patriotic* spirit of the bees; they know that the queen is essential to the prosperity of the commonwealth, and as such, and not as caring a straw or a crumb of wax about her individual person, they cherish her devotedly and show their lives to be bound up in hers.

The one great object of her existence being the perpetuation of the species, her majesty seems intent on nothing more, during her royal progresses through the hive, than peeping into the cells as she passes them, ever and anon selecting one, within which she proceeds to insert her abdomen, and to deposit at the bottom an egg. These eggs are about the size of those produced by a butterfly, but they are more elongated, and of a bluish-white colour. So prolific are some queens that I have sometimes witnessed an extraordinary waste of eggs when, as the combs have become in great part filled with brood or honey, she finds a difficulty in meeting with a sufficiency of unoccupied cells.

In such an emergency, impelled by necessity, the eggs are dropped at random, and carried off or devoured by the bees. No doubt an early and productive season tends often to this result, and marks the necessity of a timely temporary addition to the storing room of the family. The great laying takes place in April and May, and the number of eggs then laid in a flourishing hive ranges usually from a thousand to fifteen hundred or two thousand per day, and has been known even to exceed three thousand.* But when we take into account the enormous demand for the supply of swarms, the constant deaths occurring in the course of nature, and the thousands of lives always being sacrificed by casualties of various kinds, both at home and abroad, even this high estimate need cause us no misgivings. As the cold weather advances, however, there is a tremendous falling-off in the number of eggs, though the interval is very short in which the queen, in a flourishing hive, discontinues laying more or less. "Indeed," observes Mr. Golding, "it appears that at any time when the temperature is not too low for the bees to appropriate the food that is given to them, the queen will deposit eggs." In November and December, however, there will be comparatively none.

The queen's rate of feeding varies very naturally in proportion to that of her laying. It is the duty of a

*Von Berlepsch had a queen which he observed to lay six eggs in a given minute, 3021 in twenty-four hours, 57,000 in twenty days, and to keep on for the five years of her life at a rate of at least 300,000 per year. Similarly Dzierzon tells us that even the generality of queens will in a favourable season produce 60,000 per month, and a superior one will lay over a million eggs in the four years of her life.

portion of the workers to supply her with honey, as well as with pollen prepared like that used in preparation of the royal jelly. She has no objection however to sucking honey direct from the cells upon occasion.

We often read of the combats between rival queens when there happens to be two in a hive, but though such have in numberless cases been witnessed, it is now established that there are great numbers of exceptions to the rule, if indeed it can any longer be considered the rule at all. Very commonly the new-comer is at once destroyed by the workers, while instances are anything but rare in which the two are permitted to reign together. In the case of Italian bees it is stated by Von Hruschka that the latter course is actually the law as soon as the elder queen has entered her third year. But on the other hand the rivals have been often seen to grapple each other in mortal combat till one of them is pierced by the sting of the other—this being the only occasion in which a queen will ordinarily make use of her sting. Similarly it is known that a princess on first coming from her cradle-cell, will rush straightway to tear open the other royal cells and destroy her rivals before they issue forth.

The following points should be noticed in correction of the statements found in older works: the rule of the queen in the hive is anything but absolute, the workers very often entirely controlling her; the personal love which these are said to evince for her is really a mere matter of business

and law; there is no such thing as a guard in attendance on her, though the nurses when feeding her may present that appearance; and lastly, as we have just seen, the presence of two queens in a hive does not invariably result in a fight.

THE COMMON OR WORKING BEES

Are the least in size, and in point of numbers in a family are variously reckoned at from twelve to thirty thousand, according to the bulk of the swarm; though under certain circumstances they are sometimes much more numerous—indeed from thirty to fifty thousand may be set down as the average population of an English hive in a settled condition. As regards sex, we have already seen that there is no reason to doubt that there are females, only that the reproductive organs and ovaries are not so fully developed as they are in the case of a perfect queen; and this has led to the erroneous use of the term *neuters*, as sometimes applied to the common bees. If any doubt should remain as to their sex, it is removed by the knowledge that, in some instances, they are able to produce eggs. Like the queen, each has the power of stinging. The use of the sting, however, usually involves a loss of life, for, being barbed like an arrow, the bee has rarely the power of withdrawing it.

The eggs for workers are deposited in the common cells in the centre of the hive, such being the part first selected for that purpose, the queen usually laying them equally on each side of a comb, and nearly back to back. In three or four days' time they are

hatched, when a small worm is presented, remaining in the larva or grub state four to six days more, during which period it is assiduously fed by the nurse-bees. The larvæ then assume the nymph or pupa form, and spin themselves a film or cocoon, the nurses immediately after sealing them up with a substance which Huber* calls wax. It is, however, a mixture of wax and pollen, being thicker, more highly coloured, more porous, and less tenacious, probably to afford air, and facilitate the escape of the imprisoned tenant. This takes place about the twentieth day after the laying of the egg, unless the process has been somewhat retarded by cold weather. The attentive observer may at this time, in a suitable hive, witness the struggles and scrambling into the world, generally by its own exertions, of the now perfect *imago*, the little grey new-born shaking, brushing, and smoothing itself, preparatory to entering upon the duties of life.†

The observations of recent years have added greatly to our knowledge respecting the arrangement of these multifarious duties. It was one of the few errors put forth by Huber that there exist two separate *classes* of worker bees—the indoor and the outdoor. This

* See "Observations on the Natural History of Bees," by Francis Huber: English edition, London, 1841. An invaluable work to the scientific apiculturist.

† As soon as the young bee comes forth, the others partially clear the cell, and it again receives an egg; this being often repeated four or five times in the season. Afterwards the cells become the receptacles for honey or farina; but they are found in time to become contracted or thickened by this rapid succession of tenants, and the consequent deposits of exuviæ, excrement, &c. It has been asserted by Huber and other naturalists, that young bees, bred in old contracted cells, are proportionately smaller in size. Such combs should be removed from the hive. Brood-cells are at once distinguishable from those containing honey by the dark colour and convexity of the former.

distinction is now definitely ascertained to be one of *age* alone. The young bee upon quitting its cell takes upon it a share in the home labour—cleansing or ventilating the hive, secreting wax or constructing comb, sealing the cells or warming the eggs; or it becomes a nursing bee and supplies food as above described to the queen, the larvæ, and even the drones. It must attain the age of at least four and it may be ten days (for observations have as yet given no exacter limit) before it commences so much as sporting before the hive; and it is a few days later still—somewhere between ten and twenty from its birth—before it flies boldly abroad and engages in the task of honey-gathering.

Much that is very interesting might be added, if our limits permitted, in reference to several of these duties. The work of ventilation in hot weather is carried out by two detachments—the one stationed outside the flight-hole and driving in fresh air by fanning with their wings, and the other just within the hive, and expelling the foul air in a like mode. The process of wax-secretion is described further on under the chapter headed "Summer Management." Another home occupation popularly ascribed to the workers—that of acting as sentinels—is now discarded as equally erroneous with that of serving as a guard to the queen; for as no bees are to be found at the entrance at the seasons when invasions are most likely to occur, it is a safe assumption that those so found in the summer time are there either as fanners or as a matter of personal choice. The adult workers—that is to say, those that have passed these few days

of early life—occupy themselves exclusively in field tasks, except when there are an insufficient number of younger ones to attend to them. The bees' out-door labours are also adverted to under the heading just noted, as well as in the section upon "Bee Pasturage."

The longevity of the working bees has often furnished matter for dispute, and erroneous ideas have been engendered where a family has been seen for a series of years to continue in a populous and thriving condition. But during this period the queen (or more than one in succession) has been incessantly occupied in laying eggs innumerable, to supply by new births the place of the countless thousands of bees that periodically disappear. Their dwelling has remained, but successive generations of tenants have kept its works in repair, giving way in time to fresh occupants. The determination of the age they do really attain has been rendered comparatively simple by the introduction of the Italian bee; for nothing more is needed than to substitute an Italian queen for a common one, and then to note carefully the interval before the last of the old variety has disappeared from the hive. The results vary widely according to the season of the year, for the summer labour, especially if the bees have to fly great distances, or amongst corn or other vegetation damaging to their wings, will shorten their lives from four to ten fold. In fact during this season an active worker can never live longer than three months, while numbers will be worn out in as many weeks, and six weeks is set down as the average summer term of

existence. But those born at the end of the gathering season have been known to live for fully eight months, while if deprived of a queen and well fed (for they then *will not* work), the same bees have been sustained for from ten months to over a year.

To enter properly into the senses and faculties of bees would necessitate a chapter upon their anatomy, and for this our limits cannot make room. A few brief sentences must therefore suffice. Their principal eyes form lobes at each side of the face, and each eye resembles a multiplying-glass consisting of some thousand separate lenses, each of which is constructed with most marvellous intricacy. Besides these a bee possesses three small globular eyes on the top of its head. The insect manifests considerable power in distinguishing colours. The seat of hearing is undecided, but probably in the antennæ—for that they do hear may be set down as quite certain, if only from the responsive pipings of rival princesses. The sense of smell is thought by many to reside in the same organs, though this is less clearly established. But with these it is certain that they communicate with each other, and telegraph round the hive the state of affairs and the decrees of their own will. The same antennæ are of course their most delicate organs of feeling, and altogether if these are removed the insect becomes useless. The tongue resembles an elephant's proboscis, and none will need assurance of bees possessing an exquisite sense of taste. True they like many things which we do not, but that only exemplifies a well-hackneyed proverb. They perform the most essential services to flowers by conveying the

pollen about from the male to the female organs (from stamens to pistils), when these are situated in different flowers or upon different roots.

Bees know the members of their own colonies—it is supposed from a particular smell belonging to each hive. If a bee enters a wrong hive it will very probably be immediately put to death, and thus when the intruder recognises its blunder it becomes flurried and seeks to escape—an act which only serves all the more to attract attention to its delinquency. But during the gathering season, when stores are plenteous, there is much more of a "communism of dwellings," and a strange bee bringing in a load and depositing it without scruple, is usually admitted without scruple too.

We might here allude to a prevalent error as to any inherent difference, local or otherwise, in the characteristics of the domestic honey-bee. When we hear it said that some are "better workers" than others, all that ought to be understood is, that the former have the advantage of being under favourable circumstances as to locality or season, with a fertile queen, and an abundant population; for without these essentials, every operation goes on sluggishly, and prosperity becomes hopeless.*

THE DRONE OR MALE BEES

Are computed in the early part of the summer at one to two thousand, and upwards, in a stock-hive; but

* Of course this paragraph has no reference to the debated question as to the superiority of Italian or other foreign varieties.

the numbers are irregular, for a weak stock will often have an undue proportion. They possess no sting; are larger, darker, and more hairy than the common bees; easily distinguishable by their heavy motion on the wing, and by their louder humming or *droning*. There is a strong odour about them.

After her great spring laying of common eggs has far advanced, and as an invariable preliminary to the construction of royal cells, the queen proceeds to deposit eggs intended for the production of drones or males, though often without discontinuing those for workers, and in fact filling the cells of the one or the other indifferently as she comes upon them in her progress. In the first year of her life a queen of the ordinary breed usually lays very few drone eggs. Italian queens however are said to disregard this rule, and the circumstance is alleged against them by those unfavourable to the foreign variety. The drone eggs are laid in cells larger in diameter, and deeper and stronger than the others, and usually placed towards the outer extremities of the hive. A longer period is necessary for the development of a male than a female, and the drones pass through their various stages in from twenty-four to twenty-six days, being seldom seen till about the beginning of May (though occasionally earlier), and then only in warm weather, in the middle of the day. These are the produce of the first-laid eggs; for a second smaller laying of drone eggs commonly takes place about two months later, though the males are rarely found after August, unless under certain contingencies.

The drones take no part in the collection of stores, nor in any operation or process of the hive, from which fact they have proverbially suffered much reproach really ignorant and absurd, since nature has denied them the necessary means, and in their creation has allotted them a distinct office. Indeed, their flights from the hive are only occasional short ones, and they rarely alight during such excursions. They are of the male sex, their presence in a hive being only required at that particular period when the young queens are arriving at maturity. Pairing invariably takes place upon the wing, or at any rate abroad from the hive. The virgin queen then sets sail from home, and will continue so doing day after day if unsuccessful in mating upon the first flight. Having at length been met by a drone—who forfeits his life as the speedy or in most cases the instantaneous consequence—she returns to the hive with the male organ adhering to her extremity, and constituting what is known as the "wedding token." No attempt should be made to release her from this, as the consequences are dangerous to her; but she will as a rule succeed in detaching it by her own efforts, and will in the course of two or three days commence her functions as a mother bee. It has been debated whether this pairing takes place between a queen and drone of the same or of different hives. It appears established that there is no actual law in the matter, but as a point of fact, interbreeding would seem the exception. That cases of the latter have occurred is altogether beyond dispute, nay more, the pre-

sumption is that they are by no means rare; but such will scarcely happen when the union is consummated remote from the hive, and a recent instance has been cited in which the pair had met from a distance of five miles—the production of a mongrel brood in a cottage garden proving that a drone of the only Italian colony in the district must have come upon the queen though at this wide interval of space.*

"Naturalists," says Huber, "have been extremely embarrassed to account for the number of males in most hives, for they seem only a burden on the community, since they appear to fulfil no function. But we now begin to discern the object of nature in multiplying them to such an extent. As fecundation cannot be accomplished within the hive, and as the queen is obliged to traverse the expanse of the atmosphere, it is requisite that the males should be numerous, that she may have the chance of meeting some one of them. Were only two or three in each hive, there would be little probability of their departure at the same instant with the queen, or that they would meet in their excursions; and most of the females might thus remain sterile."

Were any doubt to remain on the subject, perhaps the annual destruction of the drones by the workers throws the most satisfactory light on the design of their creation. This process varies in point of time, according to circumstances. If we deprive a hive forcibly of its queen, then, according to

* Cited by the "Renfrewshire Bee Keeper" in the *British Bee Journal* of May, 1877

Bonner* and Huber, no expulsion of drones occurs. "In such cases," says the latter, "they are tolerated and fed, and many are seen even in the middle of January." They are retained under the inspiration of hope, for a contingency might arise to require their presence. Where a necessity for swarming has been in any way superseded, there are either no royal cells constructed, or the young queens meet with premature destruction. Then frequently commences an early expulsion of the drones, thus rendered purposeless; they become mere consumers, an incumbrance in the hive, and as such, the worker bees instinctively wage fierce war upon them, ending in total annihilation; nor are even the male larvæ allowed to remain in their cells. Very little actual stinging takes place, but the drones are attacked and worried away from the stores of provisions, until, when thoroughly weakened from exhaustion, they lose all power of resistance, and are driven forth one by one to perish in the cold. Care should be taken to prevent their stifling the hive by dying in a pile at the entrance-hole. This expulsive process often commences under such circumstances, in the middle, or at any rate towards the end, of May, as I have repeatedly witnessed, and not unfrequently is again resorted to later on in the season. On the other hand, in the case of swarming hives it does not take place till July, or even later, according to season and locality, when all the royal brood is disposed of.

* A Scotch apiarian of the 18th century; not to be confused with Bonnet. The observation has since been confirmed by others.

The circumstances differ in the two cases; and the bees in this, as in other parts of their practice, are sufficiently utilitarians to modify their proceedings accordantly. In the one instance the office of the males is rendered void, and in the other it is indispensable to the young queens. Such of these as go forth with swarms become fertilised in two or three days after (though sometimes it is later than this), and then follows the laying of eggs in about a similar distance of time. Thenceforth they remain fruitful, without the subsequent presence of a single male in the family till the following spring. The destruction of the drones, therefore, be it sooner or later, may be considered an indication that the hive contains no queen brood, and, consequently, that no swarming is to be expected.

Conflicting opinions have been formed as to the desirableness of assisting the working bees in the task of expelling the drones—often a protracted process, for although the latter are not armed, like their more numerous opponents, yet their superior size and strength dispose them often to make a stout resistance. If it can be done at once, without undue annoyance to the family, much fighting and valuable time may doubtless be saved by interfering; but no advice can be worse than that of attempting to accomplish the work piecemeal. When attacked, the drones, to stave off the impending storm, will congregate together in a remote part of the hive. Observation led me to think they would at such a time be glad to retreat for still greater safety into a separate box, so placed as to be accessible to them.

Accordingly, on a 14th of June, in one of my collateral stock-hives, where the drones for a day or two had been hard pushed by the others, I opened a communication on the ground floor into an empty side box. My theory was completely realised, for the poor drones gladly made their way into this, where they remained clustered at the top like a swarm—not a single working bee accompanying them—and would probably have been starved. The following morning I took away the box of drones and destroyed them, counting rather more than 2200, besides some few that had escaped; altogether a greater number than the usual estimate gives to a family. I did not find among them a solitary working bee; nor could I discover in the parent stock-hive one remaining drone. The bees peaceably at once recommenced work, and did well; as if glad in this wholesale way to be rid of their late unprofitable inmates. What was the cost of their daily maintenance? And what proportion to the entire population of the hive did the drones bear? After this apparently large abstraction, *no sensible difference was observable in the crowding.* In this hive the usual second laying of drone eggs took place, and a good many more drones were expelled at the end of July. I have not been enabled to repeat this experiment, but have no doubt it would always succeed under similar circumstances.

LAWS OF REPRODUCTION.

Within the course of the present generation the most surprising discoveries have been made in this field,

and mainly owing to the researches of the justly famous Dzierzon. It has long been known that an unfertile queen will frequently lay eggs, but that such eggs invariably hatch into drones. This fact—now recognised by the term parthenogenesis, or virgin breeding—is in itself sufficiently marvellous, as furnishing an instance in which life can be imparted by the mother alone, and showing that the male sex of bees require no male side in their parentage. Still it remained an enigma how the queen could lay both drone and worker eggs after her fertilisation had once been accomplished, and moreover how the respective sexes should uniformly be hatched from the cells designed by the workers for each. Observation abundantly proved that the same queen laid eggs in drone and in worker cells, that those laid in the former did really develop into drones, and that she often shifted about in her laying, from drone to worker or from worker to drone, just as the cells happened to fall in her way.

Both the queen herself and her eggs had to undergo rigorous microscopic examination before the key to this mystery was found. The reproductive organs of the queen are arranged in this manner. She possesses two ovaries or egg-bags, and proceeding therefrom are the oviducts or egg-passages, which presently unite in the form of a letter Y. Placed upon, and opening into the united passage, there is a small round vessel called the spermatheca (seed-case), and this vessel was found, in the case of a fertile queen, to be filled with the same fluid as was met with in the male organs of the drones, while with an unfertile

queen it was occupied quite differently—the one containing some millions of spermatozoa and the other none at all. Then came the search for a distinction between drone and worker eggs—eggs which to the closest scrutiny hitherto had proved absolutely identical both without and within. But Professor von Siebold, under the auspices of Baron von Berlepsch, at length told a different tale, for he proved the important fact that worker eggs contain within them spermatozoa, while drone eggs are absolutely destitute of such. Thus it became evident that every egg, as it originally issued from the queen's ovaries, was a *drone egg*, but that if on passing the spermatheca a compression was given which caused one or more spermatozoa to enter it, the sex of the egg was thereby changed, and it would require to be laid in a worker cell.

A controversy has since been raised as to the actual cause of the compression just noticed, for it appeared to some that the queen did not administer the squeeze herself, but the cells administered it for her. Thus the late Mr. Wagner of Philadelphia started the theory, which long found favour with very many, that when the queen's abdomen was inserted in the worker cells, the narrow limits of these compressed her, and thus produced fecundation of the egg, while the more spacious drone cells had no effect of the kind. This hypothesis was ingenious, but assuredly very unhappy and unnatural. For the queen's spermatheca is of infinitesimal dimensions, and thus any external process of pinching which would not cause it utterly to collapse, must necessarily itself be infinitesimal too.

To obtain this result with absolute uniformity, it must be essential that all worker cells and all queens' bodies should be of mathematically the same size, and that the one should be inserted into the other in the same invariable posture and angle! For how otherwise could such exquisite delicacy be regulated, except by an adjustment controlled by the queen's own will—a gentle touch against *one side* of the cell, that was as easily effected in a wide as in a narrow one? But there is no conceivable reason to drive us to even this last hypothesis, for it is at variance with all the analogies of nature that the queen should possess an organ which she has no power within her of controlling. We may therefore dismiss every vestige of this uncalled-for supposition, and be satisfied, on the one hand, that just as the workers know the sex for which they are constructing the cells, so the queen too knows the sex of them when they are constructed; and on the other, that as in her rounds she comes upon each class of cells, she adapts her eggs by her own power accordingly. The demonstrations of Von Berlepsch have satisfactorily proved such to be the case, and the mechanical Wagner theory may now be said to be melted into air.*

The fact of the descent of male bees from the mother alone can be made obvious to the comprehen-

* The Baron proves his case by the citation of a host of exceptional instances in which the space within the cells could not possibly influence the result—such as the hatching of drones from old and thickened cells *no larger than those of workers;* slender queens laying worker eggs as extensively as larger ones; workers issuing from newly formed cells which had *no sides* when the eggs were deposited; and the hatching of workers by thousands from *drone* cells if the queen is kept in a hive containing no others.

sion of all from the following circumstance, which is another of the valuable discoveries due to the introduction of Italian bees. If the queen of the one breed is impregnated by the drone of another, it is only the workers of her progeny which turn out mongrels—the drones all retain the pure breed of the mother herself. Thus the introduction into an apiary of a single Italian queen is sure to be followed by the raising of pure Italian drones, and this circumstance may be turned to advantage by the intelligent bee-keeper in preserving the breed from speedy degeneracy.

A few particulars may here be added to those which were given on this subject under the section on "The Drone." The queen commences her wedding flights on the first fine day after she is two days old (many instances are later, but this is the date fixed by the best authorities). She will continue them day after day until her object is achieved, but of this there will be very little hope if they are prolonged beyond four weeks. Dzierzon and Von Berlepsch state that they have met with positive instances of success up to a period of from thirty to forty-six days from birth; while they have known queens protract them, hopelessly after date, for a term of even three months. It is only during the first few weeks of her existence that she is capable of receiving impregnation, and if this brief limit is once overpassed, she is doomed to remain for life either utterly sterile or else a confirmed drone-breeder. It is a disputed point whether a virgin queen that has once commenced the breeding of drones can ever afterwards become a fertile mother.

Langstroth says that he has had a clear instance of this change for the better; but Von Berlepsch sets theory against observation, and believes that the drone eggs, which Mr. Langstroth had previously noticed, must have been laid by a fertile worker,* and not by the young queen. But it is hard to believe that Mr. Langstroth could be capable of such a mistake, and if queens are not all alike in this respect after failing to become impregnated, it seems unreasonable to conclude that they must be all alike at an earlier epoch. This, however, is another question as to which further observation is to be desired.

A few instances are recorded in which the act of copulation has been witnessed, and in two of these the drone fell instantly dead, in a third it survived for a few minutes, and in a fourth it flew away apparently unharmed. One of these cases is reported from Germany; two others are cited in the *American Bee Journal* for March, 1861, and the fourth by its British namesake for June, 1878. This last, if it could be depended upon as even a probable case of accomplished fecundation, would modify the accepted views very materially; but most unfortunately the observer did not pursue the matter, and does not therefore tell us whether the queen exhibited the "token," or even whether she proved fertilised or not—and without this information we must not depart from the established belief that the act is necessarily fatal to the male bee. The cause of this singular catastrophe is to be found in the structure of the male organ, which is a sort of

* This term is explained a little further on.

contorted tube, in its normal posture retained wholly within the body, and joined at one end with the seminal duct, and at the other with the external orifice. For such a tube to be propelled outwards, it would appear that the duct must be driven down it so as to turn it inside out like a stocking—an act requiring the exertion of extraordinary force. It involves a preceding inflation of the abdomen, and the two movements are comparable to the hasty opening and shutting of a pair of bellows. The result is an internal displacement, so violent as to cause an immediate rupture to the system; while the act itself appears to be quite impossible of accomplishment except when the breathing vessels are distended by motion upon the wing.* The remaining of the organ within the queen's body is due to the horn-like protuberances detected upon it by the microscope.

FERTILE WORKERS AND BLACK BEES.

Certain anomalous individuals occasionally make their appearance in a hive, and especially those known as fertile workers. These bees prove on dissection to possess half-developed ovaries capable of producing eggs, but no spermatheca for fertilising them, and therefore no means in themselves of receiving fecundation from the drones. It follows that they lay no other than drone eggs—a fact sufficient in itself to render their presence undesirable

* This is Professor Leuckart's very rational explanation of the otherwise puzzling circumstance that pairing is never attempted within the hive.

in a colony, but sinking into a trifle before the far greater objection that they evince a propensity to destroy any proper queen. Happily they are not very frequent in hives which are in a settled condition, but make their appearance usually in those that are queenless, destroying however any queen which the apiculturist may introduce. Their origin, to a certain extent, is clear enough—a queen is wanted for the hive, and the royal jelly is plentifully provided, but it is partaken of too late to produce genuine queens. About the third day of the existence in the larva form is the latest at which this change can be accomplished; but the bees become so demented, when deprived of their royal mother, that they supply it to much older brood—nay, to drones, and even to lumps of pollen—and the appearance in some queenless hives of fertile workers by wholesale* makes it safe to conclude that such late fostering has been the cause. Whether a worker *once hatched* can develop the same power, has not as yet been satisfactorily shown; but it is strongly so suspected by some, and it seems possible at least that such feeding upon royal jelly may account for the antipathy to queens which some individual bees so singularly manifest; the jelly sufficing, if for nothing more, to produce this feeling of superiority, and consequent animosity to rivals, which are so characteristic of the mother bee. If a fertile worker appears under normal conditions, the occurrence may

* Dr. Dönhoff mentions an instance in which the bulk of the bees in a hive developed this faculty; but without more definite particulars we cannot deduce herefrom at what precise stage of their existence they acquired the power.

be provisionally accounted for on the theory of Von Berlepsch and Langstroth, that the jelly had been purposely supplied to it when at the proper stage, but the design abandoned, and the royal cell never completed. This explanation is better than the one offered by Huber, that the jelly had dropped into the cell by accident.

These fertile workers devote themselves wholly to the office of drone-producers, and hence apparently they never fly forth for the purpose of honey-gathering. On this assumption it has been recommended by Mr. Rorl, as a ready means of destroying such a pest, to drive out all the bees into an empty hive, which is to be set up in another part of the garden; all the bees accustomed to flying will at once find their way back to their former home, but the one in question will not know the way, and will thus either be lost at once, or enter a wrong hive and be promptly despatched.

The term "black bees," when used to denote a kind of monstrosity (for very often, unfortunately, it is also applied to distinguish *brown* bees from Italians), refers to individuals of a darker colour than the rest, and destitute of the ordinary downy coat. The former feature is now declared to be the result of nothing more than a smearing with honey, while the latter is traced to a habit of creeping through narrow crevices. They are old-addicted *robbers*, says Dzierzon, and both these characteristics may be taken to point to such a verdict.

It appears, however, that really black worker bees have been met with—sometimes with the addition

of black hairs—which were so distinguished from their very birth. Still greater curiosities have been come upon which are all white or with white patches; others again that are reddish; drones with fiery red eyes, beautiful red heads, or a blue tint that disappears after the first flight; light fox-coloured drones, or black with rings like Italians; lastly, queens with yellow or red rings, or which are nearly or quite black.

THE ITALIAN OR LIGURIAN BEE.

This variety of the honey-bee was first imported into England in 1859, Messrs. Neighbour and the late Mr. Woodbury dividing the honour of having been the original recipients.* It has been rather unfortunate in its acquirement of a name, for

* As our author played a part in the introduction of this bee into England, it may be not unacceptable to our readers to learn some further particulars. He was at the time chief apiarian correspondent to the *Cottage Gardener* (now the *Journal of Horticulture*), and on July 15, 1859, there appeared in its columns a communication from him, stating that a friend—whom we learn from "The Apiary" to have been one of the Messrs. Neighbour—had just shown him a letter in which a M. Hermann, of Tamins-by-Chur, Canton Grison, offered to supply a new variety of the honey-bee, which he recommended as highly superior to the common one. A week or two later we find in the same paper a long and interesting letter from Mr. Woodbury ("A Devonshire Bee Keeper"), in which he states how he had been fired by this announcement, and had promptly applied for one of the new queens to be sent to himself. In a most entertaining manner he describes the receipt and introduction of the yellow queen and her "thousand people"—how he united these with a queenless stock of ten or twelve times that population, and how a murderous battle ensued in which "British valour was triumphant" and the over-matched and travel-worn Italians were all slain *to a bee*, with the single and all-important exception of *the queen*—this last fact illustrating in a most striking degree the intense feeling of regard for the royal mother which is engraven in the minds of our insects. Several letters follow at intervals, all of which well repay perusal.

whilst "Italian" is in strictness far too wide, "Ligurian" is at least as much too narrow, for the bee in question is chiefly found in Lombardy, Venetia, and the south-east of Switzerland, with only off-shoots as it were in Piedmont and Genoa to represent ancient Liguria. The name "Italian" is a shortening of "Yellow Italian Alp," which was the one given it by the foreign bee-masters who in our own day brought it into notice, and which was a designation as correct as could be desired, but too long for practical use. "Ligurian," on the contrary, was the term chosen by the first modern observer who appears to have taken note of the variety—the Marquis de Spinola, who found it in Piedmont in 1805—but who cannot be pronounced its original discoverer, as the two kinds of bee were distinctly described so far back as by Virgil and even Aristotle. In adhering herein to the former name we have been swayed by the universal practice of American and German writers, to which there is no such unanimity in our own country to oppose, though custom certainly rather inclines the other way.

As remarked in our opening section, this bee is on all hands allowed to be only a variety of the common brown insect. Its principal point of difference consists in the more or less orange colour of the upper rings of its abdomen; but this orange varies to so great an extent that while the bee may sometimes be taken for a species of wasp, it is at other times so little different from our own that it would pass unnoticed by most people as anything out of the common. The drones are always light yellow underneath, instead of whitish as with our bees;

but the queens are more diverse, being sometimes, according to Von Berlepsch, "bright yellow varying into a bluish." In anatomical structure no difference whatever has been found; but an American lady, Mrs. E. S. Tupper, states in a prize essay that the proboscis of the Italians are longer than those of the brown bee, as she proved by exposing food under a perforated cover and finding that the former continued to suck after the syrup had been so far sunk in the vessel that all the brown bees had deserted it. But in its habits and economical value there is an all but universal consensus of opinion in favour of the new-comer. It is stated to be at once more productive of honey and more prolific of offspring, more industrious and less afraid of the cold, more courageous, but much less addicted to stinging. This phalanx of alleged virtues, together with its manifestly handsomer appearance, have rendered it in great demand—even more so in America and Germany than with ourselves. Baron von Berlepsch, it is true, retracted his first high estimate and took to denouncing the bee as a "humbug;" and Mr. Pettigrew has long taken a similar line in this country. But Dzierzon, Langstroth, and apparently *every one else* known in the apiarian world, have with more or less warmth sounded forth the praises of the stranger. The additions that it has brought to our scientific knowledge are valued equally by friend and foe.

The bee-keeper who desires to Italianise his apiary need not, unless he chooses, buy entire hives of the foreign bees, but can commence by the purchase of

a single queen, which, with a few worker attendants, can readily be obtained throughout the summer months. He has then to pursue the ordinary process of supplying a new queen, or he may carry out the somewhat more elaborate directions given by Mrs. Tupper in the prize essay above referred to, and which we may not unacceptably here reprint, premising that for English practice the dates must be altered to *at least a month earlier*:—

"The queen with which you commence should be pure beyond doubt. Purchase of some one who will warrant her, and whose guarantee you can trust—remembering that in the beginning you will be no judge of her purity. The fall is the best time to purchase your queen, because she will then be ready for early operations the next season. Introduce her into the best and strongest colony you have, for safe-keeping through the winter. If you have but a few colonies, the work for the next spring is very simple. About the middle of May, if you examine the hive containing your Italian queen, you will find drones in all stages. Then take the queen out, and confine her in a cage, made by rolling a piece of wire cloth four inches square, into a tube, tying it firmly, and putting a wooden stopper in each end.* Next remove from another hive its queen, and having killed her,† insert the queen-cage between the two frames, and keep her there forty-eight hours. Then release her, and that hive has an Italian queen. The one from

* Queen cages can be bought if preferred; two forms of them are described further on.

† Don't do this for a day or two—you may have to replace her if the new queen comes to grief.

which you took her will preserve her pure drones with care, and immediately proceed to rear queens. In ten days you will find from six to twelve queen cells nearly ready to hatch. Then take the queens from as many hives as you have queen cells, and leave them queenless about ten or twelve hours. Then from one of the hives take a centre frame containing brood, cut a hole two inches in diameter; cut out one of the queen cells from the hive containing them, with a little comb each side of it, being very careful not to press or injure it in any way; dip the edges of it in a little melted wax, and insert it in the frame, and put it back in the hive. In nine cases out of ten this cell will be gladly received by the bees, and hatch in a few days. This process can be repeated with as many hives as you have cells, and if done by the last of May or first of June you may be quite sure that these young queens will be fertilised by Italian drones, *because you will have no others in your apiary so early in the season.** One or more cells must be left in the hive where they are reared, that it may be sure of a queen; and all your hives should be examined from time to time, to see that the cell in each hatches, and then to be sure that the young queens all lay at the proper time. I usually find them *depositing eggs* between the third and twelfth days after they hatch. If any colony fails to secure a fertile queen

* Even by the 1st of *May* you could not be quite sure of this in England, for drones of the brown variety do frequently make their appearance in April. Hence the Italian drones should be watched for from so early as the 10th of that month.

in this way, insert into it, from the hive which now contains your Italian queen, a frame containing eggs, and from that they will rear others. Before doing this, look over all the frames carefully to see that they have not commenced cells from their own eggs.

"After you have a fertile queen in each hive, watch the young worker bees as they hatch, and if all, or nearly so, are slender in form and have three distinct golden rings, you may *hope* they are pure. If there is a doubt about any one, you can exchange it for another at your leisure. Bear in mind that the main thing the first season is to get a young queen in every hive reared *from the one you purchased.* That accomplished, all your drones will afterwards be pure, and young queens reared from that time forth will be sure to meet pure drones. The following spring your hives will have drones in them two weeks in advance of all black bees in the neighbourhood; and if yours are strong, and you make early swarms, the chances are much in favour of your queens being purely fertilised.

"The second season of your operations all doubtful queens should be replaced; and if pains be taken you can easily have none but pure queens in your hives while the original queen which you purchased lives. I find the temper and disposition of the bees a better test of purity than their markings. The Italians are more easily managed, and less easily provoked to anger. If you open a hive of them, and lift out a frame, instead of flying in all directions and getting in a rage (as do the black bees), hardly a bee leaves the comb—all cling to it quietly

until it is replaced. Where you find them thus clinging to the comb you have one good mark of purity." She adds, however, that the only *certain* criterion is the markings of the young *queens;* she has had mother bees which produced workers, to all appearance pure Italians like themselves, but which in their royal progeny proved at once that they were only hybrids.

The above directions are intended for frame hives; but the substitution can be effected in the case of skeps also. What extra labour there is in their case is occasioned by the difficulty in removing the old queen; for if the hive be queenless, there is nothing to do but to introduce the Italian by a cage through the opening at the top. But in the more usual case the course to be followed consists in driving out the bees into another skep, and then searching for and removing the old queen, after which the new one may be inserted by the cage as above, and the colony left to return quietly to their home. Before queen-cages were so generally used, a plan existed of sprinkling the bees with syrup flavoured with peppermint, and then throwing the new queen in amongst them to take her chance. In this case, the bees having first been scared with fungus smoke preparatory to the driving, and then newly flavoured so that they have ceased to recognise their friends by their smell, the new monarch has a prospect of obtaining a favourable reception before they are sufficiently themselves to realise that she is a stranger. The latter portion of Mrs. Tupper's directions however have no application to any

other than movable-frame hives, so that in the case of skeps the simple plan must be to insert a living queen in each hive to be Italianised. She may be so introduced at any time of the year which is preferred, and where once placed she will permanently remain. One of these courses must be pursued whenever a new queen is introduced into a hive; and it will be better for the sake of beginners if we add that the above caging of the queen will be requisite on the first autumnal introduction into the frame hive as well as at the transfer in the spring.

The great trouble to the apiculturist in respect of this process is the liability of the colonies to degenerate into mongrels; and though many are of opinion that half-bred Italians are even superior to the pure ones (except as to their temper), it is still desirable to be able to put a limit upon the intermixture. This power it would appear that we now do possess. The precautions specified above would go a long way to securing this end, and the excision of drone comb from the other hives provides a further guarantee, but one which could not be relied upon when another apiary was in the neighbourhood, or even within half a dozen miles. But we now hear of successful efforts at obtaining the pairing of bees *under confinement*, and after its having been considerably adopted in America, we find in the *British Bee Journal* of August, 1878, a letter from the gentleman who writes under the name of "Dr. Pine," which states that be has partially succeeded in a like effort in this country. Those who

are familiar with Cheshire's or Aston's drone-trap will readily understand the principle of his method, which consists in affixing over the mouth of the hive a contrivance of the same kind as these traps, but considerably larger; the bees all seek to make their exit through this, but the perforations are too small to afford escape to either the queen or the drones, so that the pairing must obviously take place within the cage or else not at all. In conformity with the principles laid down at the close of the section on "Reproduction," it would seem that such cage ought to be both large and airy enough to afford to the drone a *bona fide* flight in the fresh atmosphere. Unless this rule is thoroughly carried out, we suspect that success will always be only "partial."

Another method comes from Germany and has been highly commended. The young queen may be placed in a small hive with a frame or two of workers and the particular set of drones of which one is desired for her mate (if hatched in a nucleus hive, that will be just the thing); and forty-eight hours after her birth this is transferred bodily into a cellar or some similarly cool and dark place, and there kept till the afternoon of some sunny day free from wind, and when the thermometer is not lower than 70° in the shade. Then at about five o'clock—at which hour the regular drone flight has ceased, and there will consequently be no fear of intruders marring the result—the hive is brought out and placed towards the sun, and if possible at some distance from the rest of the apiary. If a

little liquid honey is now squirted or dropped within the entrance-hole, the worker bees will presently be drawn forth and fly around the hive; after these the drones and queen will issue, and the return of the latter must be watched, and the process repeated, if necessary, day after day until she exhibits either the "wedding token" or else a marked abdominal expansion. The hive must be brought back every evening to its place of confinement until the end is satisfactorily achieved.

The extent to which the Italianising process has been pursued, and also that to which the two breeds tend naturally to intermix, are strikingly illustrated by a statement of Mr. Cheshire that "the black bee hardly now exists—everywhere he has been improved by foreign blood." He adds, "In 1874, in a most isolated moorland in Northumberland, where frame hives were unknown, but where little skeps abound, we failed to find a pure specimen of the English variety."* So much the stronger is the reason for a discontinuance of the confusing term "black;" that of "brown," which we herein have adopted, was more correct from the first, and can by no possibility perplex or mislead.

EGYPTIAN AND OTHER FOREIGN BEES.

We have room for only a few sentences in reference to the other foreign varieties and species alluded to

* "Practical Bee-Keeping," p. 80.

in our first section. The following are all with whose names we have at present met: native to Germany are the Luneburg Heath bees, the Carniolan, and the Lower Austrian; a little further afield we come upon the Herzegovinian and the Grecian; then the Cyprian, the Smyrnæan, and the Egyptian—not to mention the Asiatic and one or two other Indian species which seem incapable of domestication. The first of these, commonly called simply the Heath bees, appear to be distinguishable from our own in no particular as to anatomy or marking, but only as to habits. The Carniolan (*Krainer*) bees have whiter rings, and so have the Lower Austrian, but now and then an individual of the latter has a red mark upon the first ring. Of the remainder all that need be said is that the Egyptian are a very distinctive and beautiful bee, and probably a separate species, though all do not allow this. The rings on their body, which are orange, are as clearly marked as those on wasps, and they are clothed all over with a white down. They possess two very striking peculiarities—the first that they never use propolis, but substitute wax; the second, and a still more surprising one, that they appear to be accompanied in every colony by a fourth order of individuals, consisting in about a dozen of what may either be called fertile workers or drone-producing queens, but differing from either of these classes as we find them with other bees, as they are like queens in form, but smaller, and are marked, as are the drones that they and they only produce, by a yellow spot upon

the breast. The Cyprian bees are intermediate between the Egyptian and the Italian. As to the others, they have been "heard of," and that is nearly all.

Of the characters and relative values of these different bees, we are as yet possessed of very insufficient information. They have mostly been cultivated upon too small a scale to allow of authoritative judgments being put forth and received. Opinions in fact are often diametrically opposed, and the nearest approach to a careful estimate that we have come upon, consists in the following paragraph, which we cull from the *American Bee Journal* of May, 1877, and which is given as the outcome of a discussion between apiculturists of Silesia:* "Between the German [English] and Heath bees there is no particular difference. The Egyptian bee ranks after the German and Italian; the Carniolan, at the expense of honey, produces many bees; the Cyprians are diligent, but quite inclined to sting. The Herzegovinian bee is praised.

* On reference to the *Bienen-Zeitung* of 1876 we found the full report of the above discussion, and are disposed to think that so far as it goes the conclusion may be regarded as of real judicial weight. The Heath bee, of which we never hear in this country, is spoken of as "cultured into goodness" in its own district (from Sleswick to Oldenburg), but when transferred to other parts it regains its "natural wildness," ceaselessly swarming, and hence yielding no honey. The Cyprian, says Günther, who opened the discussion, "is beautiful, industrious, and fruitful, but a fearful stinger." (Messrs. Neighbour once imported a stock, and pronounced a like opinion). No special allusion is made to the Lower Austrian, and it is evident that it is included with the Carniolan. This would seem a pity, as the latter has received but a qualified praise from the assembly. The former inhabits the neighbourhood of Vienna Dathe, who is one of the largest rearers of bees in Germany, announced soon after this that he had discontinued the keeping of the Cyprian, Egyptian, and Carniolan kinds.

Bees obtained by judicious crossing have the preference over the pure races." Baron von Berlepsch highly praised the Lower Austrian and not one besides; the Heath bees he most vehemently denounced.

SWARMING (OR SINGLE HIVING) AND DEPRIVING SYSTEMS.

The multiplication in the natural manner of families or colonies of bees is accomplished by the secession of a portion of the inhabitants of a stock-hive, which has become over-peopled, with insufficient room for the breeding and storing departments. This act of emigration or swarming is sometimes an affair of expediency only; and by a timely enlargement and decrease in the temperature of the hive it may often be prevented. As soon as warm weather sets in, a common-sized hive becomes crowded and heated to excess; and at length a separation of the family becomes a matter of necessity. In anticipation of this event, royal cells are constructed and tenanted for the rearing of young queens, for without these no swarming occurs. A crowded dwelling therefore naturally prompts to this preliminary; whilst, a large hive, on the contrary, has the effect of retarding the formation of such cells, and the migration of which they are the precursor. In the words of Gelieu,* "In the swarming season the strong hives are almost entirely

* See "The Bee-Preserver." by Jonas Gelieu, translated from the French: Edinburgh, 1829. This valuable little work contains the substance of sixty-four years' experience.

filled with brood-combs. At that time also honey becomes abundant; and when fine days succeed each other, the working bees amass an astonishing quantity. But where is it to be stored? Must they wait till the young bees have left the brood-cells, by which time the early flowers will be withered? What is to be done in this dilemna? Mark the resources of the industrious bees. They search in the neighbourhood* for a place where they may deposit their honey, until the young shall have left the combs in which they were hatched. If they fail in this object, they crowd together in the front of their habitation, forming prodigious clusters. It is not uncommon to see them building combs on the outside."

In general, honey-gathering is altogether suspended, necessarily, under the circumstances we have stated; and, after a long course of inaction, in the very best part of the season, swarming follows. Indeed there always appears to be a connection between swarming and idleness, induced by a succession of interregnums in the government, causing a suspension of breeding, when little or no store of any kind is collected. The proprietor must therefore make his election as to his course. If the multiplication of stocks is his object, his bees may thus be impelled to throw off swarms, but he must abandon the prospect of a large harvest of honey under such circumstances. This method of bee management is usually called *single hiving*, and is that commonly followed by cottagers. On the

* From the context it is clear Gelieu on'y meant to imply some place of deposit in proximity to the parent hive, and not anything actually apart from it.

general subject of swarming we shall enter more at large under the head of "Spring Management."

The substance of the foregoing paragraph may be made a little more plain to the beginner, who may not unreasonably complain of the term "single hiving" as specially invented to confuse him. It is the *other* system which retains the single hive according to the ordinary English meaning of the words, while the one so called consists in forming a *number* of hives, but each one of them is "single," that is, unprovided with supers or other extra boxes for the storage of honey. Were he to follow this system exclusively he might multiply his bees at an enormous rate, but no one hive would have any appreciable amount of honey to spare; while by adhering with equal exclusiveness to the depriving system, and checking every disposition to swarm by providing further accommodation in the existing hive, he may reap immense takings from this one hive, but of course he can never overpass a certain limit. The population of any one hive, under equal conditions, will remain the same year after year, since increase of bees is only to be obtained from the increase of queens. Von Berlepsch says that he has had certainly a hundred thousand bees living at a time in the same hive, but this must surely have been under his prodigy of a mother bee who laid three times that number of eggs per annum, and it will be a practical impossibility in a general way to attain to such a number. Any bee-keeper, therefore, who makes "progress" his motto will not be content with keeping any one hive wholly and permanently to itself, however glorious the

results it may have brought him. But on the other hand Mr. Langstroth's advice must be heeded, that even to double the stocks every year is often too fast a rate for obtaining a surplus of honey. A middle course between the two systems is therefore advisable. But surely, the more gatherers the more honey, it may be argued. Ultimately so, but not till a settled condition is reached. Suppose there are sixty thousand bees in a hive, and half of these leave in a swarm. This half can store no honey in their new residence till they have first formed the wax and built the combs, and though they perform this with great rapidity, yet each worker must fill itself with honey abstracted from the old hive in order to acquire the power of wax-secreting; then, while the old hive is nearly emptied of its outdoor workers, a large portion of those in the new one, *all* outdoor by profession, will be required at home, sealing up the cells and nursing the brood—and thus about an entire month in the best portion of the year will find many of them diverted from the pursuit of honey-gathering, to which, had they remained where they were and with plenty of room provided, every one of them would have been able uninterruptedly to adhere.*

The advantages afforded by the frame hives now adopted by nearly every systematic apiculturist permit of every desirable variation in the rate at which swarming is suffered to be carried on. The bee-

* Till the contrary is proved it may be taken as self-demonstrating that none but adult bees go with a swarm—not necessarily the very oldest, but those only whose regular period for flying has arrived. Hence the above assumption that *all* the home-workers in a new colony are outdoor labourers diverted from their natural calling.

keeper whose object is the raising of honey rather than of bees for sale, has one single purpose to be steadfastly kept in view—how to secure the largest number of *strong stocks*. No swarm, therefore, must be allowed to escape from a hive on such scale as to leave the hive otherwise than strong, or indeed to be otherwise than strong itself. All this is now readily practicable from the opportunities, by extracting single frames and so forth, of raising a single swarm from two, three, or half a dozen different hives, or of obtaining two swarms from three hives, three from four, or any other modification which existing circumstances may seem to recommend.

Mrs. Tupper, in her before-mentioned American prize essay, makes the following practical remarks upon this point: "In most places I think bee-keepers will find it pay best to secure a moderate increase every year by making one swarm, very early, from *four or five* old ones. In this way, quite as much, if not more, surplus honey will be obtained as when there is no increase, and the value of the new swarms (whatever that is in your locality) is just so much extra profit." The explanation of the freedom from loss by swarming upon this system lies in the fact that a change into an empty hive gives the bees a spur to extra exertion; for though this would be nothing like sufficient to balance the loss above described, where an entire swarm is taken from one and the same hive, yet it is sufficient, or even more so, when each of several colonies is only just appreciably diminished in population. When so managed, an occasional renovation has everything to be urged upon its side, not the

smallest of the advantages being that it gives to an old stock the change to a younger queen.

We have therefore to observe the natural instinct of these little animals, and at the proper season to provide them with such an occasional addition of storing room as will enable them uninterruptedly to go on constructing fresh combs—by the workmanship of the natural indoor labourers—to be filled with honey, unmixed with brood or other substances. This temporary receptacle, though in communication with the stock-hive, can at pleasure, in the way which will hereafter be described, be detached from it, without injury to the bees; these returning to their original habitation, in which the mother bee ought exclusively to carry on the work of breeding. The honey obtained by this act of *deprivation* is always supposed to be in excess of what is required for the wants of the family, and almost invariably pure in quality. Various have been the contrivances for effecting the separation of the storing and breeding departments in a hive. The bees, when pressed for room, will extend their operations almost in any direction, whether the accommodation is given above (which is termed *storifying*), at the bottom (*nadiring*), or *collaterally*. Equally indifferent are they to the material of the temporary receptacle. A second hive, box, or glass, placed over the stock, is termed a *duplet*, or more commonly a *super;* by which general name, as we proceed, any kind of storing vessel so placed will be designated. A productive season sometimes admits of a second super (usually introduced between the first and the stock), called in such case a *triplet*. An

empty box or hive, pushed beneath a full one, is denominated a *nadir*—a species of help not always advisable except in the case of swarms of the same year, or towards the latter end of very abundant seasons. A still smaller addition to a common hive consists merely of a few bands of straw, on which it is raised temporarily, and this constitutes an *eke*. When either this or a nadir is used, and to facilitate its subsequent removal, a board ought to be placed between the stock-hive and the nadir, to prevent the combs from being worked down into it. The nadir will correspond in principle with the stock-hive, but if movable bars or frames are not adopted in it, then its board may either be pierced with good-sized holes throughout, or it may be cut into the form of a grate, with the openings about half an inch wide. The entrance to the stock-hive must be stopped, and one made at the bottom of the eke or nadir. We shall hereafter describe a modification of the nadir principle, which, by way of distinction, I have called *nethering*.

The preference given to either of the two schemes of bee management we have just detailed, must direct the proprietor in the choice of his hives, and we shall proceed to describe such of them as have found most favour among modern practitioners; premising that in using the term *hive*, we intend its general acceptation, no matter of what material it is made. Neither is it our object unduly to magnify the advantages of wooden hives at the expense of those of straw: prejudice exists on both sides of the question. They are each valuable according to circumstances and their intended uses. Moreover, he only deceives himself

and others who imagines he has discovered a system or a hive by which to command an abundance, or an improved quality, of honey at pleasure. A favourable season may crown with success some cherished theory or mechanical device, to be followed in the next by disappointment; for he has little studied the natural habits of bees who believes they can be made at will to conform, under all circumstances, to any settled scheme of practice we may devise for them. The attempt has led to the Babel of contrarieties too frequently exhibited amongst apiarian professors, to the confusion of the novice; each deprecating everything except the mode of procedure he has found applicable to his own case or district, and with which of course he is most familiar. In the words of Mr. Golding, "Let my readers repel the quackery which would have them believe that it was the *kind of hive* which commanded the honeyed store. No; that will be ruled by the productiveness of the season and the locality."* Having taken the honey-bee under our especial protection, we are bound to provide for its due preservation from the effects of climate, &c., and perhaps, in addition to the ordinary attentions, the most that can be done with permanent advantage is to furnish our intelligent little workmen with a dwelling convenient in its form and arrangement for the intended purposes; bearing in mind, as a general rule, that these are best consulted by an attention to simplicity in its details.

* These remarks are obviously intended to have but a limited application. Mr. Taylor himself is never slow to inveigh against a hive constructed upon a wrong principle.

COMMON STRAW (OR SINGLE) HIVES.

In their wild state, bees have most usually found a secure residence in the decayed trunks of thick forest trees. Where they are domesticated, the kinds and shapes, as well as the materials, of bee hives vary according to climate and locality, or the purse of the proprietor. Those used in many parts of this country are made of straw, of a bell shape, and being intended for single hiving, are usually without any means of enlargement. At the end of the second or third year, they are too often placed over the pit of destruction; and thus, with a little impure honey, flavoured with brimstone, the scene closes. Is it surprising that an unpleasant association is thus connected with the use of such hives? Happily for the cause of humanity, experience has decided that this consequence is not inevitable; and I trust I shall hereafter point out the method by which it may be avoided, and make it appear to be the interest of the proprietor *never to kill* his bees, let the hive be of what kind it may.

Common hives are best made of unthreshed rye, or good wheat straw. They would be much improved by a greater attention to shape, being usually too high in proportion to the width. It may be well, in this connection, to introduce the observation of Gelieu. "One of my chief objects," says he, "has been to ascertain what shape of hive is the most profitable; and with this view I have tried all the different kinds, and have invariably remarked that bees thrive better in low hives than

in high ones; that in general those which are broad and flat amass more honey, thrive better, and give out stronger and earlier swarms than those which are high. A hive thrives only in proportion to the success or perfection of its brood-comb in the spring. It is therefore of great importance to keep up the necessary degree of heat for the hatching of the brood. If, at that time, the bees are lodged in high and roomy hives, they will crowd together in vain, and the heat ascending is lost in the empty space above. This never happens in low flat hives, where it is more easily concentrated."

To prevent the combs from falling, sticks are commonly put across, or along the inside of a hive, as a support to them. But these props are an annoyance to the bees, presenting difficulty in subsequently extracting the combs, and are never required in a hive made with a proper regard to proportion; in other words, where the combs are not too large to bear their own weight when fully loaded. As regards the area of hives, much difference of opinion prevails, and a certain degree of latitude must be left for circumstances connected with locality, &c. Credit has been taken by some apiculturists, and doubtless with reason, for much reducing the unwieldy hives of our ancestors. On an average, perhaps, a preference may be given, as regards a common bell-formed straw hive, to one made fourteen or sixteen inches wide, and from eight to nine inches high at the centre of the crown, both inside measure.

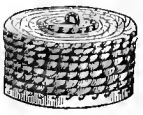
There will be less of room wasted in a hive thus formed, inasmuch as the combs are stored down to the bottom cells, which is rarely the case in a high and narrow one. A low wooden hoop is often used, worked at the bottom of the hive; or, as Dr. Bevan says, "the lower round of straw may be begun upon a wooden hoop, the bottom of which has been planed smooth; it should be perforated through its whole course, and the perforations made in an oblique direction, so distant from each other as to cause all the stitches of the hive to range in a uniform manner." The hoop gives greater stability to the hive, preserves the lower edge from decay, and affords facility in moving it.

The custom of plastering round the bottom edge of a hive with mortar or clay is better omitted. Its own increasing weight will settle it down to its board: at all events no cement is equal to that used by the bees themselves; any other only serves to accelerate the decay of the hive, besides presenting an impediment on occasional removal for cleaning or inspection.

STRAW DEPRIVING HIVES.

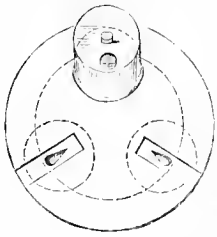
Straw skeps are best adapted to the depriving system when made rather cylindrical than bell-shaped, and as nearly as possible flat on the top, so as readily to support a bell-glass or other form of super. The bee-keeper who prefers to be his own hive-maker has first to purchase a skep with a fairly flat top, and measuring inside about sixteen

inches across and nine in height (if as flat as the one below, it will be all the better). Through the top he will cut a hole three or four inches in diameter, and fit to it a lid of worked straw for closing this hole when the super is not required—placing a small weight upon it or else securing it by pins. The result will be represented by the accompanying figure, except that Mr. Taylor is now considered to have gone a little *too* far in advocating hives of a shallow form. At the proper time for applying a super, the straw mat cover can be removed, and its place supplied by what is termed an adapter or adapting-board, which is a thin board to lie upon the crown and sufficiently large for the super to stand safely upon it. It must have a corresponding hole through its centre; thus in fact *adapting* it as the floor-board to a super. It will be preferred by some, instead of one thick adapter, to have two very thin ones, of equal form and size, placed together. These should be made of mahogany or some hard wood, as a security against warping. When the super is ready for removal, a detachment of the two boards can be effected by passing between them a knife, or some fine wire (if there is only one, this is detached from the super). A piece of thin metal may first be used to stop the communication.



With a little additional trouble the bee-keeper may cut away the top of a common skep and substitute a wooden crown-board in the manner here represented. The pins driven into the hive will pre-

serve the board from lateral movement, while the weight of the super, or in its absence the cover (for which see next section), will hold it firmly down. The board can, if preferred, be cut in three slits as in the annexed figure, the three being contrived to admit of either three bell-glasses or one of the wider kind introduced by our author, and known as Taylor's glasses. The dotted circles show the double adaptation thus designed. When these are in use they should be covered by a second skep hive, in addition to the cover already hinted at, which will now be placed over all. The slits in the board may be an inch and a quarter or more across in the widest part and taper into a point, their length being two inches. Three zinc slides or dividers move in grooves cut two inches wide from the edge of the board and over the holes. If any interstices are left after fitting the woodwork into the straw, these can be stopped by the insertion of a bit of tea-lead, "a store of which," says Mr. Golding, "should be kept for such purposes."



Those who would wish for a double adapter to the hive last described, would similarly desire a single one to place upon the crown-board of that now under notice. Expert apiculturists would laugh at either idea; but Mr. Taylor, in noting the convenience of such double boards, had view mainly to beginners of a nervous temperament, who desired,

during their operations, to keep the insects shut in to the utmost possible extent. The confidence gained from a very little experience of the subduing efficacy of *smoke*, will convince the bee-keeper that such precautions are not necessary; but nevertheless we shall adhere in this edition to our author's practice of adverting to the use of these boards. It must be understood, also, that *single* adapters are often really indispensable, as when a crown-board is made without openings, and is intended to be wholly removed when the super is applied—the adapter being then probably perforated all over with holes just large enough to admit a working bee, but too small for either the queen or the drones—and there is also the case in which it is desired to apply a bell-glass to a hive with a straw top. In this last instance, as nothing but straw will stand properly upon straw, this top must first be freely covered with clay, dough, or any other kind of luting, or even with the tea lead just mentioned, and then an adapter must be placed upon it; indeed, whatever kind of super is employed, it is far better to place an adapter over a straw crown, for as, in default of frames, the combs are sure to be worked down to the crown itself and attached thereto, it is impossible to separate them neatly from the uneven surface of the straw by the usual process of passing a wire between.

If three glasses are applied, then, if the "cautious" system is followed, there must be a separate small adapter to each. On the removal of a full super, its slide is first closed, and then its adapter is detached from the crown-board and taken off with the glass as

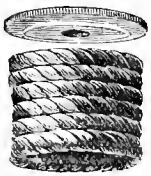
above. Without any adapter, the super itself is detached and removed alone.

We have here been assuming that glass supers are to be employed, but this is by no means an essential. The bee-keeper who gives them his choice is directed to the remarks headed "Bell-Glasses," near the close of the chapter on "Summer Management." The common bell-glasses used as shades have no opening to admit of ventilation, and should therefore be avoided. But, instead of glasses of any kind, a straw super may be fixed upon, and then all that is necessary is to procure a second skep small enough to stand upon the first, and to admit of a third being placed over it for a cover, as in the case of the bell-glasses in the last paragraph (indeed, this third hive may be dispensed with, provided some other cover is substituted; but a complete jacket for the super is highly advisable). With a flat-topped hive or a wooden crown-board, adapters may be used in the same manner as with the bell-glasses.

A straw super can also be made of the same flat and cylindrical form as the stock-hive above described. The size may vary in diameter, according to season and locality, from ten to thirteen inches, or even the full width of the stock-hive, and three to six inches in inside height. In good years two or more of such supers may be filled in succession, the appearance of the hive determining the expediency of such additions. Should the stock-hive become hot and crowded before the first cap is entirely filled, a second smaller one (or triplet) may be added. In such cases, the first super is always to remain the upper one, for it

would be useless to put the triplet anywhere except beneath this; while the one now added must have a two-inch hole in its crown as a passage upwards for the bees. In moving the first super, the upper half of a double adapter can be lifted with it (but should not be retained if its hole is narrower than two inches), first introducing between the pair a piece of zinc or tin, to stop the communication with the stock-hive. In order to give the straw supers a better footing when placed one upon another, some persons prefer an extra cord or rim of straw to be worked round the outer bottom and top band. As it is essential to preserve the super from cold, it is far better for the real super to be a *smaller* cylinder enclosed by the upper of these two hives (which will then be made with a crown). To enable the super to be of the full size of the stock-hive, there should be a jacket fitting over all, like the one upon page 72.

Those who choose may have the supers made without crowns, which gives facilities for fitting them up to serve any required purpose. This is done by means of loose wooden crown-boards: they may be prevented from warping by being made of two circular smooth boards glued together, the grain of the wood crossing. These boards are of different diameters: the smaller circle falls within the inner diameter of the cap; the other should be made an inch or more larger, to rest upon the upper edge of it. The engraving annexed will illustrate

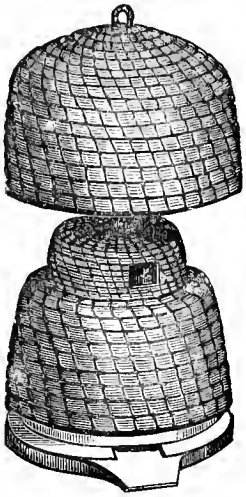


our meaning. A small weight for a day or two will adjust the crown to its place. The crown-board to the stock-hive can be fitted in this same manner if preferred; indeed, a variety of methods could be adopted.

An annual coat of paint should be given to straw hives, and nothing looks better than a natural straw colour. As to the comparison between straw and wood, attention may be drawn to the words of Gelieu, who says, "It is commonly supposed that bees thrive best in straw hives, because the straw absorbs the moisture, and the combs are less liable to mould. For my part I can perceive no difference. The bees are careful enough to varnish over the interior of the straw hives with a coating of wax, or rather propolis, to prevent the settlement of moths; and in old hives this varnish is so thick that no moisture can penetrate between the cords of straw. Wooden hives will also absorb moisture to a certain extent; and experience has shown me that it is a matter of indifference which are employed, except as to the price." To this we may add a remark from Mr. Cheshire's "Practical Bee-Keeping," to the effect that the natural non-conductivity of straw gives it an advantage to begin with, but that wooden hives can be so constructed as fully to rival it in this respect; and this end will be accomplished to a certainty if his own plan is followed of making double walls with an air space between. Upon this see the description of his frame hive further on.

Of skep hives ready adapted to the depriving system, Messrs. Neighbour offer a far larger variety

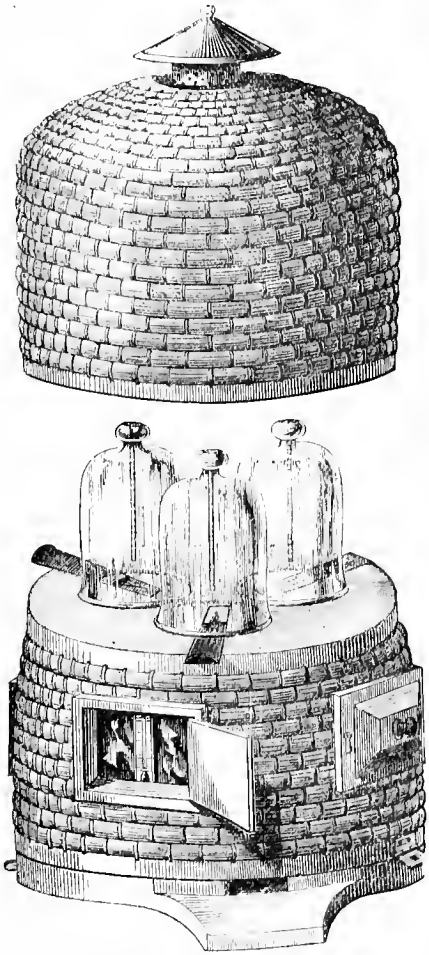
than most of the makers.* Their very simplest construction of this class is on a pattern already described, consisting merely of a common skep, with a second, its exact miniature, standing upon it. The price of this hive is 5*s.* 6*d.* Much superior to this is the one here represented (price 10*s.* 6*d.*), which is termed the "The Cottager's Hive." It has its super of a very shallow construction and provided with a window; while the cover-hive, superior floor-board, and hooped base add to the completeness and durability of the whole. The crown of the stock-hive is flat enough to receive an adapting-board.



A very much more elaborate structure than either of these, or perhaps than any skep hive hitherto made, is the one sold by this firm under the name of "Neighbours' Improved Cottage Hive," of which an enlarged representation is given overleaf. The stock-hive is furnished with a wooden crown-board, as well as with three windows closing by hinged shutters and one of them containing a thermometer inside; the hive itself being hinged to the floor-board. Upon it stand three bell-glasses holding six pounds of honey each, and supplied with green baize bags for increasing the warmth; while

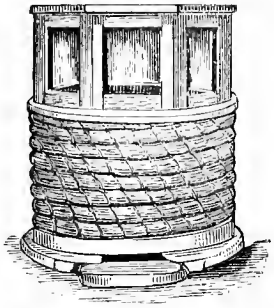
* Messrs. C. J. Sanders and Son (223, High Holborn) provide a similar series, and we have some obligations to acknowledge to them.

above all is a cover-hive with a hoop fitting outside the crown-board, and a painted zinc ventilator at the apex. The price of this hive is 35*s.*, but 10*s.* can be saved by dispensing with windows and thermometer, while there is also a variation at 21*s.* in which the ventilator too is absent, the three glasses are reduced to one Taylor's glass, and the crown-board cut down to an adapter, but one window is restored (no thermometer).

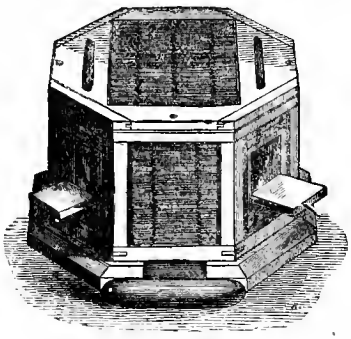


Mr. James Lee also sends us a form of skep hive, fashioned upon our own author's principle, and termed "Taylor's Improved

Cottage Hive." It has a wooden crown-board with zinc slides, and behind it a window; while the super is octagonal with opening glass sides. This is sold at 22*s.* 6*d.*; but with a straw super and no window a hive of like construction ("The Economic Hive") can be had for 11*s.*, or without the floor-board 7*s.* 6*d.*



Our next cut exhibits "Lee's Octagon Straw Hive," which furnishes a connecting link with the bar hives described further on; both it and its super being provided with *fixed* bars ranging front and back beneath the crown. The super has glass sides and top like the one shown above, and access is given to it by the slits at each side of the crown-board. The price of the stock-hive is £1, the supers varying according to make. The cover is shown at the end of the section on "Frame Hives."



As to the course of procedure to be observed with hives of this class, the same general directions will apply to all that we have yet described. The lower or stock hive is devoted entirely to the use of the queen, and whatever honey is there deposited must be left

for the sustenance of the family. Even were any of it extracted, there would be no dependence upon its being free from brood-cells and pollen; while the supers can be shut absolutely against the queen by simply placing what are called queen-preventers * over the holes of communication. During the winter time the bees will be wholly excluded from the supers —indeed these will be removed bodily from the hive if the arrangements of the outer covering enable greater warmth to be thus secured. But when, at the end of April or a little later, there arrives a time of pleasantly warm weather, it will then be proper to afford the additional storing room. Again, a new swarm, whatever the season of year, should be allowed from two to three weeks to furnish its stock-hive, before its attention is distracted by admission to the super. The signs of the requisition of this will be an excessive heat of the weather, a crowding of the bees at the entrance, an appearance through the windows of approaching completeness, or a rising of the thermometer, where present, to 90 degrees or thereabouts.

SKEP COVERS.

Whatever difference of opinion there may be as to the expediency of the practice of placing straw hives in the open air, independently of a house or shed, the custom prevails to so great an extent that our object would be incomplete were we not to point out some of the modes resorted to for protecting them in such cases. Of the commoner kinds

* A frame of wire, slits, or perforations just large enough to admit a worker, but excluding the queen or the drones.

of coverings, many are sufficiently unsightly; some being of straw thatch (or hackles), others of earthenware, in various ugly forms, and often objectionable and injurious to the hive from their weight. The catalogues of our hive-makers will present us with various species of covers in zinc or wood, but the bee-keeper can readily provide them for himself by coiling and riveting a sheet of zinc into the shape of a cone; or he may substitute felt for zinc, as recommended by Mr. Cheshire, tacking the edges upon a thin lath, and pitching or tarring over the outside. In either case he may advantageously follow the directions of this gentleman for cutting out two covers with the smallest possible amount of waste. A yard of felt, he tells us, costs eightpence, and measures two feet eight inches across; and as we require only three-quarters of a circular piece for each cone, we can (see

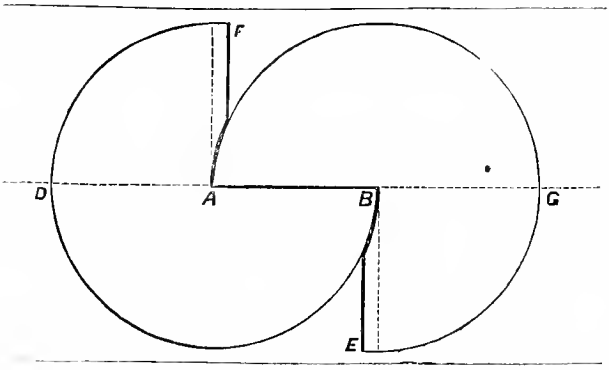


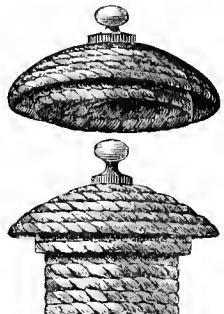
figure) obtain two covers out of a piece four feet long. Draw a line D G lengthways down the exact middle

of the piece of felt or zinc, and from a point A, sixteen inches from one end, describe a three-quarter circle, and then from B, where this meets the centre line, describe another to fit into the former. If the two incomplete circles were now cut out from the sheet, and the straight edges of each were brought together, they would be found to form perfect cones; but in order to allow their edges to overlap for the purpose of fastening, a margin of an inch or so should be given down the greater part of one edge of each cover, an arrangement which can readily be contrived by means of the waste portion which still falls between the circles. Instead, therefore, of cutting straight from the centre of each to one of the sides of the sheet, a commencement is made at F, and you follow the thickened line through A, B, E. There will thus be no overlapping of the edges near the apex of each cone, but that is of no consequence. As another form of home-made cover, a ready carpenter might incline to construct an octagonal wooden spire, which he could frame together at the base, and affix at the summit upon a block, with a ball or other ornamental projecting head.

It scarcely seems needful to remark, even in a book intended for beginners, that a square cover must never be applied to a round hive, unless it fits loosely over it like a house, for if bearing upon the hive itself it would be likely to press it out of shape, and thereby ruin the combs. Of the box class of covers we shall speak further on. Care must be taken to afford security against the upsetting of the whole structure by violent winds. If a closely fitting zinc

cover is employed, there should be interposed a small worked mat of straw bands, to prevent any ill-effect to the hive from the rays of a hot sun.

Mr. Taylor mentions the following adaptation to the flat-topped hive; and it will suit other skeps equally well: "In the apiary of a friend I have seen a dome-formed straw cover to a stock-hive, constructed with a projection all round of about three inches. On the underneath side are attached three or four bands in a circle, fitting over the outer diameter of the hive. The appearance of this cover is appropriate; but unless carefully painted, wet will eventually find admittance. It may, however, be rendered water-proof by means of some kind of cement (I have sometimes used for this purpose a mixture of paint with fine sawdust, pounded into the consistence of paste); and afterwards painted and varnished."



The introduction of his zinc covers, though these may be regarded as "out of fashion," will perhaps be acceptable to some of those home-manufacturers for whom they were designed:—

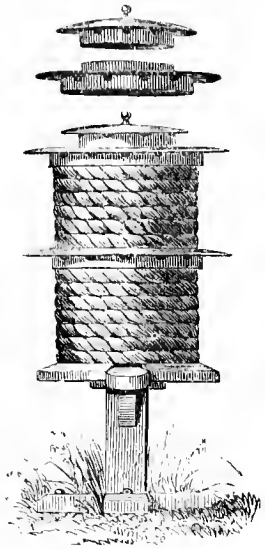
"A cover of the same form can be manufactured in zinc, more or less convex, or sometimes nearly flat, its edges being turned down over stiff wire. A descending rim of not less than two inches deep is attached to the underneath side, encircling the upper edge of the hive. There ought to be perforations

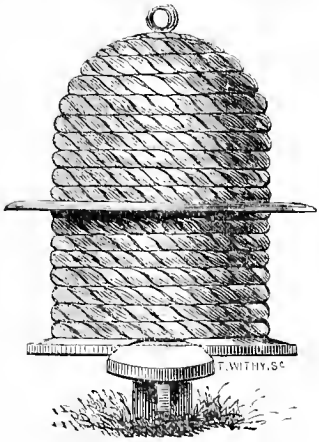
immediately under the projection of the rim, and a space left between the cover and the crown of the hive, for the passage of air; or a small worked mat, of straw bands, may be interposed [as mentioned just above].

"A modification of the last-described zinc cover I have used satisfactorily for the protecting of flat straw depriving hives requiring more than one story in height. Immediately upon the stock-hive is introduced what, for want of a more distinctive term, I call a *shade,* encircling the upper edge, as just detailed, with the same kind of descending rim and air-holes. It is made of moderately thick sheet zinc, cut of such exterior diameter as to leave a projection round the outer edge of the hive of three to four inches, and turned a little downwards over stout wire, to throw off wet. In the centre of the shade is a circular opening, which, if required, may be of the same diameter as the interior of the stock-hive, and round it is a raised rim, standing up not less than half an inch. Within this central opening it is intended to place the super, of whatever kind it may be. A reference to what has been said on a previous page * will show the construction of the shade, the upright rim of which keeps the super in its place. On the top of this upper hive a second

* The passage in question (which does not occur in its old form in this edition) remarked that supers ought to be *covered* even when within a bee-house, and that the upper hive, as here represented, was thus *itself a cover,* the super being a smaller straw cylinder within, and, as just explained, standing (upon the crown) inside the upturned rim of the shade. The closing paragraph of this section will make the arrangement still clearer.

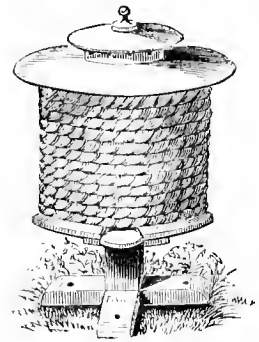
shade, made like the first, may be placed. The completion of the whole is a slightly convex zinc cap, of about two inches in height, fitting securely over the central opening, like the top of a canister or pot. There is a projecting lateral rim to the cap, underneath which air-holes are made, similar to those under the projection of the shade. In winter, and at any time when a super hive is not required, the cap is placed over the shade immediately surmounting the stock-hive, reducing the edifice to one story. When feeding is needed by the bees, a pan may be introduced for the purpose within the central opening, and covered over by the zinc top. In reply to those who are dubious as to the expediency of using metal coverings, it may be remarked that no inconvenience arises in the present case, as neither the shade nor its cover comes in contact immediately with the crown of the hive.

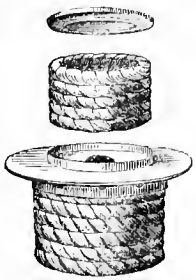




"If a straw cover to a super is preferred, it can stand over the rim of the shade, as seen in the illustration annexed [see last page].

"An effectual protection to a round hive may be made by means of an outer case, in fact merely a straw cylinder, with open ends. It must in diameter be large enough to drop loosely over the hive, and rest on the floor-board. The height ought to be sufficient to include any supers that may be required. Surmounting the whole, either one of the zinc covers, shown at page 70, of an enlarged size, can be used; or the shade and its top, as seen at page 71." Of course any of the more modern kinds could equally well be applied.



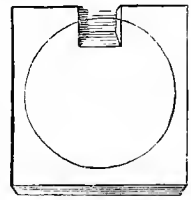


The annexed figure exhibits the position of the super as explained in the note on page 70. It need not be so small as here represented, but the rim on the shade must be adapted to its size. Enclosing it will stand the super-cover, and the whole then present the appearance of the storified hive on page 71. It will at once be seen that shades of this description will interfere with the extra rim of straw at the edge.

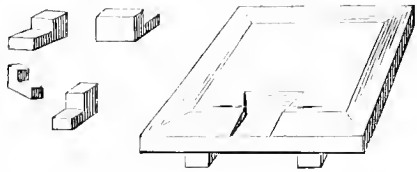
FLOOR OR HIVE BOARDS.

The floor on which a hive is placed should be of wood, and not of any material too retentive either of heat or cold, as stone, slate, &c. In summer the melting of the combs often results, and in winter numerous lives are lost from chill. Every hive, of whatever kind, should stand upon its own separate board, so as to give facility for lifting, cleaning, or weighing the whole together at any time, without disturbance to the bees.

The entrance into a hive is generally cut out of its bottom edge. This has a tendency to cause decay in that part, particularly if of straw; besides that, a hole so made affords but indifferent protection from driving wet or a scorching sun, and gives imperfect facility for the escape of moisture from the hive. It is a better plan to sink the passage out of the thickness of the floor-board, till it reaches the inside of the hive. There are several ways of doing this, but a simple one is the following: Let the board be of thick, seasoned wood, and to prevent warping, screw two strong cross-bars to the underneath side, seven or eight inches apart. In size the floor-board ought to be a little larger than the exterior of the hive, from whence it should be chamfered down every way, to three-eighths of an inch at the edge. From the latter the entrance must be cut or grooved out,

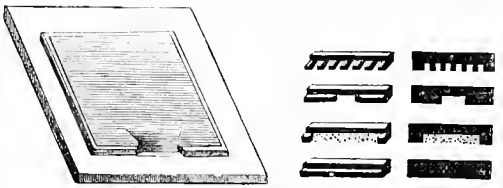


straight and level till it enters the inside of the hive, when it may slope upwards. This groove may be about four inches wide, and three-eighths of an inch deep where the hive crosses it; for it is better in all instances that the requisite space at the door should be given laterally, rather than in height. This is not only more convenient to the bees, but shuts out from admission into the hive such guests as the snail or the mouse. In a board thus constructed, a convenient mode of occasionally contracting the entrance-way is by means of small wooden blocks, of different widths, so formed that the lower half can be pushed within the hive's mouth. The board just described, and its blocks, are shown in the engraving beneath.



Another kind of hive-board, suitable for some descriptions of boxes (the square wooden hives to be presently described), is made by cutting a rabbet of any required width, and three-eighths of an inch deep, on all its sides, leaving the raised part of the board the size of the outside of the box, with an additional half-inch beyond this every way. The passage into the hive is to be cut from the edge of the rabbet, and on the same level, for about two inches; after which it must slope

upwards. It may be four to five inches wide, and its sides should bevel a little outwards. This gives facilities for the introduction of movable blocks or mouth-pieces, for the convenience of contracting or altogether stopping up the entrance, as may be required. The blocks are an inch wide (in the direction front and back), and must all be of one size, and of the same length and bevel as the entrance-way. In height they should be three-quarters of an inch in front; cut down behind, for

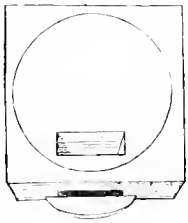


half the width, to three-eighths of an inch. Thus made, the lower half of one of the blocks is inserted within the mouth of the hive, and the other half projects on the outside. To suit all cases and seasons, blocks so formed may be cut on the lower part, from front to back, with any required passage-way through them at pleasure. The preceding engraving exhibits the hive-board described, with a back and front view of four blocks thus varied; the third one being fitted with perforated zinc.

An entirely covered entrance, for those who desire it, is afforded by a double board, in which the passage is cut through the floor, altogether within the hive; and it may be thus made:—

Take a piece of inch seasoned wood, an inch or

two broader and longer than the hive. Smooth both sides, and underneath it cut a groove four or five inches wide, and four inches back from the edge.

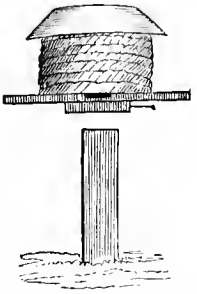


The part next the edge should be there hollowed out three-eighths of an inch deep, increasing to twice as much at the other end, where it enters the hive. An opening through from the upper side must be made, to meet the underneath hollow, giving a gradual slope down into it. A piece of three-quarter inch board, seven to nine inches wide, must then be screwed underneath, the grain crossing the other; the doorway for the bees being of course between the two. The lower board should be a little the longer, the extra length being intended to form a small alighting-board in front. All the boards in the preceding illustrations are shown square as to form; but any of them may at pleasure be made round.

HIVE-STANDS OR PEDESTALS.

Hives standing singly, in the open air, must be so placed that there is no risk of their being overthrown by the wind or other casualty, and various kinds of supports have been devised. Whatever is preferred, it ought to afford facilities for allowing the lifting up of the hive on its board at pleasure. A single pedestal or post is sometimes used, cut flat

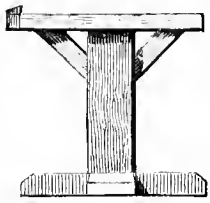
at the top to six or seven inches square. It may stand out of the ground fifteen or sixteen inches, and be firmly fixed, to avoid shaking, which alarms the bees. Sometimes a higher elevation than this is given, but it is not expedient to subject the hives unnecessarily to the action of the wind, any more than it is to place them so near the ground as to cause the bees to be affected by damp exhalations. On the under side of the centre of the hive-board fix four bars of wood, each about two inches square in section, and so adjusted as to form a cap or socket fitting over the top of the pedestal. The board may be there secured by the insertion, diagonally, of one or two pins through the sides of the cap and into the post. This plan may be varied by means of two pieces or arms, let edgewise flush into the top of a post, crossing it diagonally; on this the hive-board may rest, or be secured by a button or two.



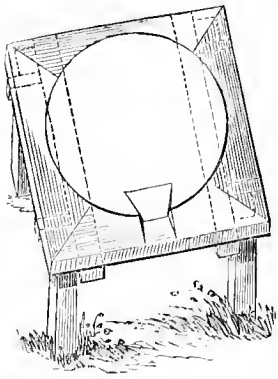
Or, on the top of a pedestal, four or five inches in diameter, a piece of board, of about nine inches square, may be fixed as a table. Upon this place the hive-board, of which the parallel bars, appended to its underneath side, are so adjusted in point of distance apart as to come on each side of the table, being there secured by a pin or turn-button.

This last-described stand may be improved, at a little further cost. Nail upon the pedestal a piece of strong board, eight or nine inches wide,

and three inches longer than the outside width of the hive-board. Underneath the table thus formed, a couple of strets or angle-pieces must be fixed, to render the whole firm. The under-side bars of the hive-board are adjusted to fall on each side of the table, as before detailed. The extra three inches of the latter must be thrown to the front, where it is designed to form a projecting alighting platform for the bees. This part is occupied by a piece of wood nailed to it, and chamfered to meet the hive-board, to which it forms a stay.



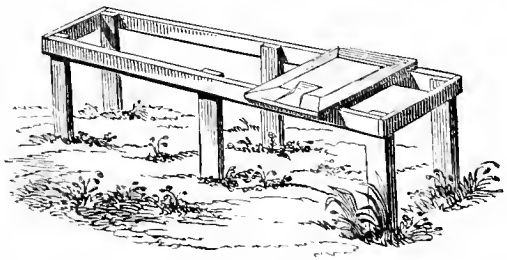
Another support to an outdoor hive is made by means of four props, driven upright into the ground, and cut off level at about sixteen inches high. The hive-board in this case has two cross-bars screwed to its under side, from front to back, just coming within the uprights: to make it still more steady, four small blocks can be appended near the corners, between the cross-bars and the edge of the board, to hold the latter in the opposite direction, as seen by the dotted lines in our illustration.



The same remark applies to the hive-stands just described as was made in the last section, viz.,

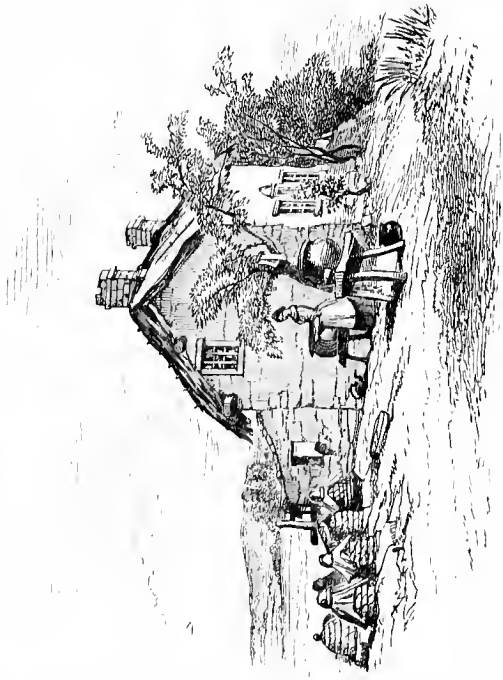
they can be adapted equally well to round as to square hive-boards. It may be well also to observe that, instead of sinking a pedestal into the earth, where decay soon ensues, it can be fixed upon strong cross pieces or feet, these being fastened to the ground by pins passing downwards through them. Pedestals of this description can, if preferred, be bought of the manufacturers ready made.

Where there are a number of hives, instead of a separate stand for each, they may be placed more economically, and perhaps safely, on what I term a *hive-range*, of any required length. The range consists simply of a couple of rails, about an inch thick, and four inches in depth, nailed to the top outer edge of a series of posts, fixed firmly in or on the ground, and about eighteen inches high. The space between the rails may be about twelve inches, measured within-side. The most suitable hive-board for a range is that shown at page 74. The cross-bars on its underneath



side must be so cut in point of length as to fall within the two rails, where they are held; whilst what remains of the width of the board lodges upon them,

with a convenient projection before and behind. Nor does it matter whether the hive-boards are made square or round. A range of this kind occupies very little space, and presents few facilities for the incursions of insects or other annoyers of bees. The hives ought to have a good interval between them; but it is



an advantage that on this plan they can be moved, by sliding the boards to the right or left, if circumstances call for it. A range on the same principle might

readily be made ornamentally, in part or wholly of iron, standing on feet, movable anywhere, and setting vermin at defiance.

To the intelligent reader it is unnecessary again to repeat, that bee-stocks ought always to be raised sufficiently from the ground to protect them, not only from the baneful effects of damp, but from the incursions of vermin, &c. But inattention on this point is sometimes met with so gross, that we cannot forbear giving place to the preceding engraving, from a drawing made on the spot in Dorsetshire, illustrating the treatment to which the poor bees may be sometimes subjected by indifference or deplorable ignorance.

WOODEN BOX HIVES

WITHOUT FRAMES.

As far as we have proceeded, our attention has been directed principally to straw hives. Those, however, of wood have in modern times come pretty generally into use, when cost is not an object, as being more durable and less liable to harbour vermin. It used, also, to be a great advantage on their side, that they could be made square, and admitted of glass windows; but both these features are now readily secured in straw hives as well.

As regards the plainer kind of boxes, either intended for use on the swarming system or on that where deprivation is practised, I adhere to the opinion expressed as to straw hives, and prefer those constructed broad and shallow to such as are high and

narrow. They may be made of the lighter and more porous kinds of deal, some preferring red cedar; but whichever is made use of, it should be thoroughly seasoned and well put together; observing that the grain of the wood always runs in the horizontal direction, when its tendency to expansion or contraction is rendered of no importance. Conflicting opinions prevail as to the best size for bee-boxes; but, like almost everything else where these insects are concerned, something must be left dependent on circumstances and locality, as well as the intended mode of working them. A fair average size for a plain box is twelve inches square, by eight inches deep, within-side;* the thickness of wood throughout being not less than an inch, or, if exposed, more than this. The cover of the box should have a small projection on all sides, for better appearance, and to afford convenience for lifting. On the top a two or three inch hole may be cut in the centre, for the purpose of supering, of feeding, or ventilation. Instead, however, of one central hole, some persons prefer to have three smaller ones, cut triangularly; affording convenience for the use of a single large, or three small glasses. It is best to leave the roof of the box, within-side, unplaned, as the bees have sometimes a difficulty in making the first combs

* A partial reaction has taken place in regard to the objection to deep hives made by Mr. Taylor and others of his day, for while it was of course correct that in such hives the heat would rise to the top, it was found that in the low hives adopted by him and Mr. Woodbury there was not a sufficient amount of heat engendered. A depth of nine or ten inches would be now preferred, or the boxes might rather be larger every way, and follow the dimensions of some frame hive in the next section. A capacity of a *bushel* is now the recommendation for stock-hives, whether wooden boxes or straw skeps.

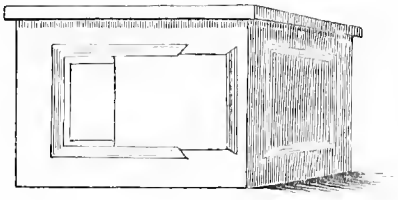
adhere to too smooth a surface. A window may be placed at the back, and another at one side, about four inches high and six wide. The glass should be thick, and secured by putty; but it must not fit too tightly, or it is apt to crack from the swelling of the wood. There are various ways of covering the windows, but the best is, perhaps, by a sliding shutter of zinc. Round the window there must be a projecting moulding mitred at the corners. On one side the piece of moulding is movable, and to the back of this is screwed a plate of sheet zinc. This passes into a rabbet to receive it, cut, on the remaining three sides, at the back of the lower edge of the moulding. Where uniformity of appearance is studied, blank windows may be made opposite to the real ones.* No entrance-way should be cut in the box, as this more properly belongs to the floor-board.

A reference to the engraving will show a box thus made, with its sliding shutter. It ought to be painted a sufficient time before use, or the smell is offensive to the bees; indeed, I have known a swarm forsake a box in consequence.† I may observe, however, that some persons prefer boxes, when in a house, to be

* As regards windows, they are always useful to inspect a hive, but should, as a rule, be kept darkened. At the same time there is no doubt that bees will work exposed to the light when the option of darkness is not allowed them. A friend put a swarm into a unicomb hive—made without shutters on each side, and exposed to the full glare of light at a window—which I frequently inspected. The bees filled the hive in a short time, paying apparently no attention to the eyes often observing their operations. It is to be remarked, however, that whether bees are in light or darkness, the one or the other *must be continuous*, as alternations disturb and alarm them. We shall hereafter give designs for experimental *observatory hives*.

† Mr. Shirley Hibberd states that he once lost a swarm from the same cause, and he well recommends the painting of empty boxes a year in advance.

unpainted. They are always best placed under some kind of cover, as protection from wet and a hot sun is



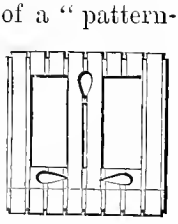
necessary to prevent warping and splitting, and not unfrequently the melting of the combs. Some German bee-keepers have recommended box-hives made long from back to front, and narrow from side to side. In fact, one of their most approved hives follows the principle of "high and narrow" so strongly condemned by Mr. Taylor; it may correctly be compared to a small glass-case standing end foremost.

BAR HIVES.

Under the heading "Wooden Bar Boxes" our author furnished a lengthy section, much of which might be readily made applicable to the frame hives which have now, as far as stock-hives are concerned, rendered the simple bars all but an anomaly. The Stewarton hive, so popular in Scotland, and indeed in England too, is however an example of their retention; and they continue to be extensively employed in the supers of frame hives. The use of the bars—a use which the addition of complete frames secures with very much more completeness—is to prompt the bees

to adopt and maintain straight combs. As one comb is to be attached to each bar, it follows that the number of these, and the intervals between them, must be accurately adjusted to the insect workmanship. The dimensions usually followed are one inch wide, and a quarter or three-eighths of an inch thick; they reach across the top of the hive from front to back, and if we attended to a recommendation of Dr. Bevan, the three or four central intervals should be seven-sixteenths of an inch, while the others gradually increased that distance up to nine-sixteenths.* The bars were at first fixed into recesses cut along the inner edge of the top of the box, but this plan is now discarded, as the bees were prone to fix the one into the other inconveniently tight. The instructions given as to frames in the next section (page 90) will provide a more suitable method.

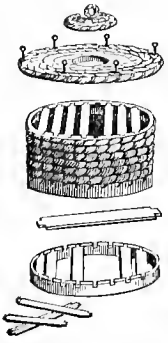
Our author, with his usual preciseness of directions for home workmanship, gives a figure of a "pattern-gauge" which he devised for regulating the position of the bars, and also of the holes for admittance to the super. He would make it of brass, or at any rate of sheet metal. In other respects the figure speaks for itself, but it is



* The inner combs usually contain worker cells only, while the outer consist partly of the deeper receptacles for drones and honey. Hence it would seem that the intervals outside of the three or four middle ones should be increased sufficiently to admit of thicker comb upon *one* side; while those beyond these two should be wide enough to take it upon *both* sides. The custom of *transposing* frames, has, however, caused this rule to be totally disregarded, and a uniform arrangement is maintained of about an inch and a half from the centre of one frame to the centre of the next.

given here merely as offering a general idea for contrivances of the kind. Of course when the super is not applied, the openings in the crown-board must be closed, either by slides as on page 58, or by any simple means that may suggest itself.

Bars of this description can be fitted to any kind of hive whatever, if only it is provided with a movable top, and the accompanying cuts show one of Mr. Taylor's straw hives so furnished, together with the method of affixing. For the purpose of supporting the bars, a well-seasoned hoop is introduced within, and on a level with, the upper edge of the hive—nearly two inches in depth and a quarter-inch thick; its interior diameter being the same as that of the hive. The two upper straw bands of the latter are reduced in width sufficiently to form a recess equal to the thickness of the hoop—the outside of the hive remaining flush. The hoop is there retained by a few small brad-nails, driven through it and into the straw; and thus no impediment is offered on extracting the combs.

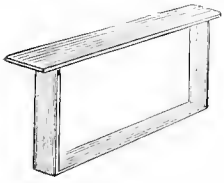


Even a hive of this kind, however, might as well be fitted at once with the bar-frames as with bars alone—at any rate as regards the middle portion. This fact is so strikingly evident that it is wholly unnecessary to pause over a further description of bar hives; for though the Stewarton must receive due notice, yet this is a structure of so highly complex a nature that we must defer it to a later section.

FRAME HIVES.

Our author in his last edition gave to the new introduction of frames a very brief and hesitating notice. They were at that date (1860) in the position of a device which nobody in this country had practically tried. They appear to have been invented quite independently in England, America, and Germany; and their final elaboration was so gradual a process that it is no simple task to assign the chief honour to any one person. Major Munn, a friend of Dr. Bevan, and the reviser of his famous work "The Honey Bee," would seem, however, to possess a clearer title than any other whom we could name, though unfortunately his invention was so hampered by faults of impracticability, that it fell upon the world almost stillborn. It was in 1851, ten years after the Major's obtaining his patent, that Mr. Langstroth brought out his hive, in the full belief that he was absolutely the first inventor of the bar-frames. He has subsequently relinquished his claim, but his inventions were of immense service in extending the adoption of this invaluable scheme. The reintroduction of the frame system into this country was effected in 1860 by Mr. Tegetmeier; but his adaptation met with little more acceptance than Major Munn's had received before it, and it was the indefatigable Mr. Woodbury who really made frame hives known to English apiculturists. In Germany the movable bars were the invention of Dzierzon in 1837, while in 1853 the frames were added by Baron von Berlepsch.

A frame consists of an addition of three other sides to a bar, thus constituting it into an oblong honey-case, which reaches down almost to the floor-board, and serves to confine the combs of honey or brood, both preserving their straightness and enabling them with ease to be extracted at any time from the hive. The directions given as to width and thickness of the bars are applicable also to the frames, but of course the length and number will in both cases depend upon the dimensions of the hive. As shown in the figure, each frame has its upper ends projecting for the purpose of suspension. Its sides should come within about a quarter of an inch of the sides of the hive; if too close, the bees will fasten them with propolis, while if too far off, they will be apt to work additional comb in the interspaces. About the same room may be allowed between the lower bar and the floor-board.



Various contrivances are adopted for inducing the bees to commence their combs evenly along the upper bars, but the simplest of these is to smear the lower edge of that bar with melted wax. Some persons take pieces of clean old worker comb, dip their edges in wax, and stick them to the bar. Yet again there can be purchased sheets of thin prepared wax for cutting into strips and attaching in a similar way, or else affixing in a slit formed for the purpose beneath or through the bar; while a modification of these sheets, known as "wax comb foundations," furnishes the bees with ready-formed pyramidal bases for their cells. But all

that is really important is to prompt them to make a true beginning, and this will be satisfactorily accomplished if we supply them with a line of wax which shall be quite straight, and not too broad. To effect this a brush and a ruler will suffice, and the line may be drawn about three-eighths of an inch in width.* For a time the desire to aid the bees in this matter took the form of inserting sheets of wax which filled the entire frames; but complaints arose that these sheets would twist and curl, and prove rather a hindrance than a help to the preservation of straight combs. Some, however, still use them.

The square form is usually observed in the case of frame hives, for though, as stated above, a round hive is capable of being fitted with frames, yet there is a convenience in being able to shift these to any part of the hive desired—and still better, in being able to shift them from hive to hive, if all are made upon the same pattern. As to material, though, as already stated, the skilled workman can now produce square hives of straw, yet the bee-keeper who makes his own hives will doubtless resort to a wooden box of the description noticed in the section preceding the last. But, as there mentioned in a note, the dimensions are better considerably enlarged; and the inside measurements of such box may therefore be put down at about sixteen inches wide, fourteen from front to back, and ten and a half deep. The general directions under the section

* Mr. Taylor advises taking a piece of sheet tin of the length of the bars, cutting along it an opening of the required width (to within half an inch or so of each end), then laying this pattern upon the bar and painting over the opening with the melted wax.

just quoted may be observed, but to prevent trouble from extra recesses in the windows, Mr. Taylor recommends (under "Bar Boxes") to cut a fine rabbet on the inner side and therein cement the glass flush with the side itself. The best kind of cement for the purpose, he says, is a mixture of powdered chalk and glue.

As for the frames themselves, several variations of detail have at different times been adopted. The upper bar has been made convex beneath instead of flat, and a ridge run along the centre for covering with melted wax; very frequently a saw cut, for the admission of wax strips, is made through the bar, and almost from end to end; in other cases this slit has taken the form of a deep groove only; and, again, a plan has long been commended by some of constructing the frames themselves somewhat wedge-shaped, or narrower at the bottom than the top, in order to give greater facility of extraction (in which case the hive itself should have its inner walls sloping to correspond, the interior measurement from front to rear being a half or three-quarters of an inch less at bottom than at top). The projecting ends extend about three-eighths of an inch, while without these the outside dimensions will be thirteen and a half inches long, and ten deep. For suspension of the frames a ledge may be carried round the inside of the top of the hive, low enough to admit of passage to the bees between the bars and the crown-board: this ledge should be sharply bevelled behind on its upper edge, to prevent propolising. For preserving the intervals unvaried, Mr. Cheshire's distance-pin, figured on page 109, is

perhaps the simplest expedient. Over the whole is placed the crown-board, which, if intended to be retained in use during the honey season, must be pierced so as to afford free passage between the super and stock-hive.

The super here again admits of the usual choice, for it may either take the form of a counterpart of the hive, exactly fitting to it, but only about half its depth, or it may consist in as many bell-glasses as can stand on the crown-board (openings being of course required in this to correspond); or yet again it may be of the shape of the stock-hive, but composed of glass, in which case, if there is not a cover to the whole of the hive, the super must be slightly smaller, so as to leave sufficient room for one to stand over it. As there is not the same occasion in supers as in stock-hives for a withdrawal of the combs with a view to examination, it is most usual to furnish them with simple bars instead of frames; but the latter are to some extent coming into use even in their case. As bees usually construct the honey cells of a deeper form than those intended for worker-breeding, it is well to set these bars or frames in the super a little further apart than those in the stock-hive; indeed, by gradually *increasing* the space as the bees progress with the filling of the cells, they may be induced to add more and more to their depth till beautiful specimens of honeycomb are produced. If the full interspaces are given from the first, the bees will be likely to start intermediate combs, so that the course must be to allow only the regular intervals to commence with—say a quarter of an inch wider than those allotted in the stock-hive. This

will involve the use of one or two frames less than what are required for the same width in the latter; and if the above artistic effect is aimed at, then one after another of the bars or frames can be removed when partly full, or the super itself might even be lessened by a process to be now explained. In all the better class of frame hives made by the regular hive-makers it is now usual to insert in the stock-hive either one or two of what are known as dummy frames, which consist of two thin boards glued together in cross directions as to the grain, and affixed underneath bars like the ordinary ones, but usually a little narrower. They are thus of the same size as the other frames, and lift in and out like them; being of great convenience for either curtailing the space of a hive too roomy for its existing stock, or, still more, for giving facility to the removal of the genuine frames by allowing them to be shifted further apart after a dummy has been first extracted. Now we have never yet heard of the adoption of these devices in supers; but for the performance of the above experiment they seem to offer the simplest of all means. Von Berlepsch says that by the process in question the combs may be brought up to a thickness of four inches.

The crown-board—also called the honey-board when intended for the reception of supers, though the latter name may in other instances refer to some forms of adapting-boards—should be three-quarters of an inch thick, and project all round for a distance of half an inch. It may either be fastened down by screws—which Mr. Hibberd has well re-

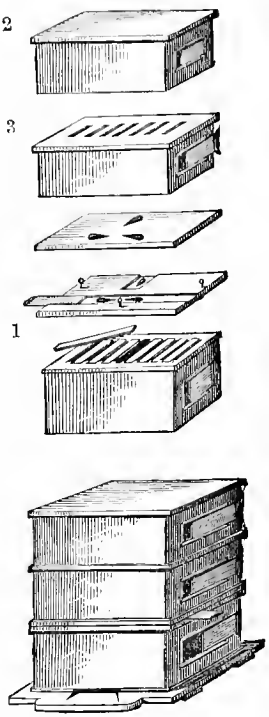
commended to be thoroughly greased before use, in order that they may easily be withdrawn—or a method of Mr. Taylor's may be simplified thus: Take an elongated metal ring, like the link of a chain; under the middle of each projecting end of the crown-board make a slit which shall be capable of admitting this link, and through the latter there can be inserted a movable pin passed through a hole made from the end of the board; a screw driven into the side of the hive at the proper distance holds the other end of the link, and completes the fastening. The usual zinc slides are fitted to the slits giving admittance to the super; and not only should the regular close slides be provided, but also a set pierced with "queen-preventing" perforations (see page 66), which are to be substituted for the first, and retained in use as long as the super is applied.* As to the slits in the crown-board (for which see the figure of the pattern-gauge under "Bar Hives"), two of them are to be placed within three inches of the front of the box (inside measurement). They are pear-shaped, and, according to Mr. Taylor, they should be three inches long and an inch and a quarter wide, but the width may be increased half an inch or so if perforated slides are to be used. They are pointed at the inner end, and leave an intermediate space of two inches. The third hole may be an inch and a half from the back of the cover, and made an inch shorter than the other two; "this will be useful," remarks the author, "in working glasses and

* A very general practice now-a-days is to remove the crown-board entirely when the super is to be affixed, and to substitute an adapter consisting of a sheet of zinc perforated all over in this manner.

in feeding." The elongated form is the best for avoiding the killing of the bees on moving the slides. These last are plates of stout zinc or copper, which draw out one on each side, and one behind the hive; they should be about half an inch wider than the cross diameter of the slits, and they slide within a recess cut in the crown-board, as shown in the figure opposite. They are long enough to meet in the centre, their outer ends being a little turned up for convenience. If the last inch is perforated with small holes, the slide becomes a ventilator by drawing it out a little. Mr. Taylor also recommends giving increased facility of passage to the bees between the bars and the crown-board by grooving out the under side of the latter for a depth of three-eighths of an inch and a width of an inch and a half, from hole to hole or down the centre. This is needful, however, only when the bars fit close up to the board; it is now usual to depress them sufficiently to obviate such necessity.

The principal features of the whole, as thus far explained, may be gathered from the opposite illustration, which served in former editions to show the construction of the author's "wooden bar boxes." It will be noticed at once that we have here three boxes, but the two upper ones should be much shallower than the figure shows, as compared with the lower, the outside depth of which should equal that of the two combined. As represented separately in the upper portion of the figure, No. 1 is the stock-hive, which is, however, to be furnished with frames instead of the bars here shown; above it

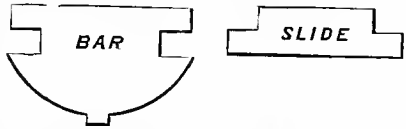
comes the crown-board with its slides; then an adapting-board, for those who care to resort to such an accessory; next the extra super, marked 3; and lastly, the first super, or box No. 2. Mr. Taylor's top super was fitted with movable bars and windows like the stock-hive, but his lower super (No. 3) differed in the former respect, for the bars exhibited in the figure are *fixed*, or in other words, are simply a grated entrance to the other super, which, though applied first, will always stand uppermost. The bars in supers are not in every case made to remove, but it is desirable that they should be so (and if frames are added, so much the better), and for this purpose the top of the super must itself be movable like the crown-board of the stock-hive. Supers of this class, like all others that we have spoken of, are, it need hardly be said, open at the bottom; they consequently will admit of the adapting-board mentioned on page 57, if such is desired. Both crown-board and adapter may be retained during the honey season, in adherence to the general line of Mr. Taylor's instructions. But in the case of the



lower super this course is not advisable, for, as will be gathered from the design of the grating, it is important to give the freest access from one super to the other; and as any adapter placed over such grated board would require to be grated itself to correspond, there would obviously be little gain to the timid from the protection of a board such as that. A middle super, in fact, should have no cover at all, so that the bees on passing through the spaces between the bars may find themselves in the top super without any further impediment. When this latter has been removed, a crown must be placed over the lower one, or Mr. Taylor's grated top will require some temporary cover to close the openings. At the commencement of the season then the stock-hive stands alone with the slides in its crown-board closed, and the addition of a single super must not be made till the warmth of the weather and the progress of the bees have rendered the increased space and ventilation both safe and desirable. A new swarm will probably require it, according to the weather, in from twelve to twenty-four days after hiving. A stock of a previous year, whose dwelling-place is ready-furnished, will need it in the first warm season in or after the latter part of April. If it should be found that royal cells are laid on, or any other sign showed of inclination to swarm, no time must be lost, and the aim should be to provide the additional room just before the commencement of all such preparations; but by promptly destroying or removing the royal cells the mischief may be stopped. The bars in the super (box No. 2) are smeared with wax, or otherwise supplied, in like manner with

the frames, and then the adapter is placed beneath and the whole put into position, after which the slides on the stock-hive are withdrawn. If it be found that this super is becoming filled before the season is near its close, the extra super (box No. 3) is prepared in like manner; then the slides on the stock-hive are closed, the old super loosened from its honey-board, and the empty super placed between the two boxes. The slides are then reopened and work begins again, both in the new and the old super, for the rule must not be to wait for the first to be *perfectly* full before the second is added.

Yet another plan which has been adopted is that of using what are known as the Stewarton slides, and though these would be too troublesome for the amateur to construct, we may here once for all describe their principle. In the figures annexed are given illustrations in section, both of the bars and the slides which slip between them —the former (to which frames can be added) being fastened by screws easily capable of removal. The projection of the one fits into the groove in the other, and by inserting or withdrawing the slides we are able to obtain just as much or as little opening as may be wished—from a grating like the above to a practically entire crown-board. Small pieces of slides will be needed to stop up the two ends of each entire slide that is removed.



It is also well to mention here the plan adopted from America by some bee-keepers, of substituting a quilt

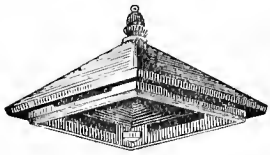
of flannel or similar warm material in place of the crown-board when the super is away. This of course implies the necessity of an additional cover, but that ought to be furnished in any case. When the super is to be put on, the quilt is removed and the adapter or honey-board takes its place. But there are grave objections urged by many competent judges against the use of the quilt, for besides harbouring vermin it is very prone to become mouldy underneath, and this immediately upon the tops of the frames. Some, however, have not observed this defect, and are warm in praise of the introduction. But the bast or phrail, of which fish baskets are made, is less open to objection, and will answer all the purpose of the quilt to those to whom the idea commends itself. It is further noticed in the chapter on "Winter Management."

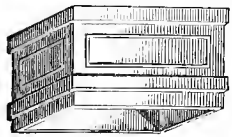
Before proceeding further it is desirable to answer the question, certain to occur to many a beginner, What is the great advantage of frame hives over the old-fashioned skeps? The one important fact out of which all their advantages grow, is that they give the bee-keeper the means of ascertaining at any time the exact condition of affairs within. He can extract any one particular comb, search for and take away the queen, and cage down a new one in her place upon the cells; or he can in like manner insert a royal cell, substitute a full comb of brood from another hive, or one full of honey if the bees are in want of food; he can remove a comb that has become too old for use, examine the combs one by one, if disease or the nests of hostile insects are suspected; or again he can carry

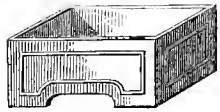
on the process of artificial swarming upon the precise scale adapted to the population of any given hive. Even the frameless bars secured these ends, but they were far less convenient and complete, from their failure to hold the combs compact for extraction, or to prevent their being affixed to the sides of the hive. Yet even of these Mr. Taylor could correctly write, "The convenience of movable bars can only be appreciated by those accustomed to their use."

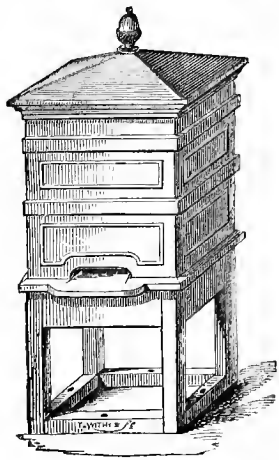
Outer Covering.—For the complete covering of hives of the box form, Mr. Taylor gives the following instructions: "These boxes, like all wooden hives, should be placed in a house of some kind, if possible; but instances occur where such a convenience is not available. To meet these, I will describe a substitute, which gives effectual protection, though it would still be better standing under a shed. A recurrence to the engraving in the next page will show that our plan comprises an outer casing, in two compartments, and surmounted by a top cover or roof. They may be of half-inch wood, large enough in the square to drop loosely over the boxes, the lower compartment resting upon the rabbet of the hive-board, which may be made as shown at page 75, and wide enough to leave, on three sides, an outside margin of an inch. On the front side a rather more extended margin may be expedient. The height of the lower compartment, measuring from the rabbet of the floor board, reaches to the top of the stock-box, except just as much as will allow the slides to pass over its edges. A good-sized elliptical opening faces the mouth of the hive; or increased to two, where there is a second

entrance. The other compartment of the case should be high enough to enclose within it the two upper boxes. To its outer bottom edge, a band or fillet, about two inches wide, and nearly half an inch thick,is appended, half its width. The other half-width is intended to overlap the outer upper edge of the lower case, when placed one upon the other; and this part should be chamfered, so as to go on and off easily. For appearance sake, another band is appended to the upper case, near its top; unless any other exterior architectural embellishment is preferred. A reference to the engraving will show that the whole design is completed by a hipped roof or cover. Under the four projecting edges of the latter is a suspended cornice, about two inches deep on its outer sides. When in its place, about three-quarters of an inch of the cornice ought to overhang, dropping loosely over the upper outer edge of the case (a little chamfered); to regulate this, recessed at the four angles,









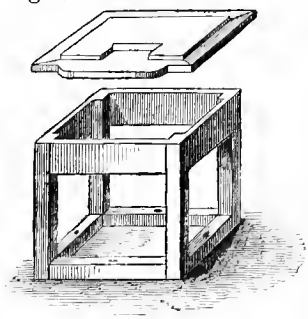
within the cover, are attached cross corner blocks. For the purpose of ventilating the roof, long lateral openings are cut out on the four sides, from the upper part of the cornice, under the projecting edges of the roof. The total projection of this may be two inches, or a little more. The cover ought to fit equally well upon either compartment of the case; for in winter the edifice can be reduced to one story only."

Finding some of his friends object to the trouble of removing covers, he devised for these easy-going apiculturists a form of hive to serve as its own cover, for the details of which it is sufficient to state that the sides are increased in thickness to fully an inch and a quarter; the crown-boards of the lower boxes project an inch and a half, while rabbets are cut in these to receive either a super or the roof cover, and the windows are protected in winter by the insertion of blocks between the glass and the shutters. The square frame within the roof has the same inner diameter as the boxes.

A hint may be taken from the Cheshire hive,

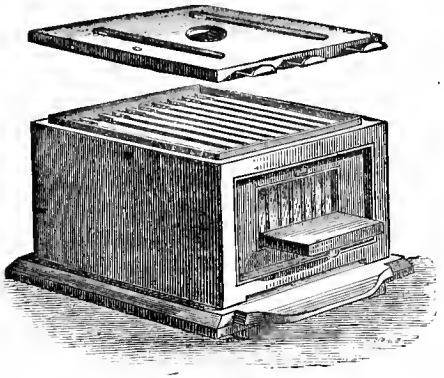
described further on, to employ double walls with an air-space between, as an improvement upon the thick single walls of Mr. Taylor. Again, a super only five inches deep may dispense with any crown-board.

Stand.—The stand for the whole is simply an open frame, of the same outside dimensions as those of the cases; with inch-thick rails, four inches deep, framed at the corners to four posts or legs. These may each be two inches square, and eighteen inches high; either sunk into the ground, or placed upon it by means of cross-pieces pinned or pegged down. The hive-board drops loosely down into the frame, and rests upon the rails, showing a projection all round of an inch; the cross-bars on its under-side retaining it steadily. The further remarks made on page 78 are also applicable here.

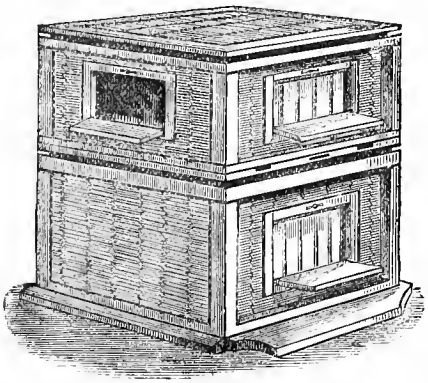


Recent Frame Hives.—We may now present our readers with illustrations and descriptions of two or three forms of frame hive as constructed and sold by the leading makers. As already noticed, the first frame hive brought into general use in this country was the invention of the late Mr. Woodbury; and the form still enjoying the widest favour is practically the Woodbury hive. This arrangement, in its original integrity as well as in several variations, is to be obtained of various hive-makers, including either of those herein named. The one we now represent is

"Neighbours' New Frame Hive," which differs in no material respect from the Woodbury, except that the depth is increased from nine to eleven inches (inside), while instead of being fourteen and a half inches square, it measures fifteen and a half from front to rear, and fourteen in width. The frames in the stock-hive are nine in number, besides a dummy, and are each thirteen inches long and ten deep. As can be distinguished in the above figure, their upper bars are made with long projecting ends for giving greater convenience in extracting them; while they rest, as does the crown-board, upon the edges of strips of zinc, which prevent the bees from propolising them down to any troublesome degree, and also, by presenting a much narrower surface, greatly diminish the chance of crushing a bee in depositing them in or on the hive. In the crown-board are two side openings for giving admission to the super, besides a central hole for the purpose of feeding. The zinc slides for closing these are seen projecting in front, but they will of course in use be placed *behind*, being, like the window, only exhibited in front to avoid



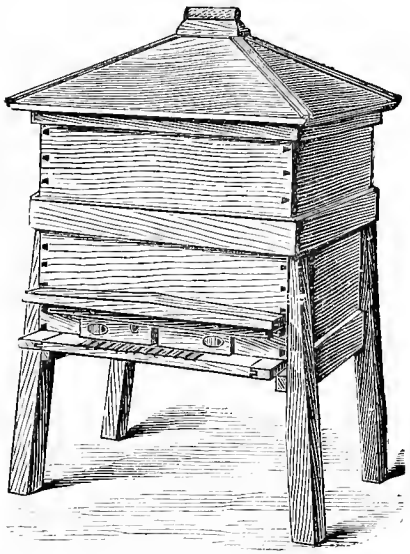
the necessity for two figures. The side openings are provided with a duplicate pair of slides, which are made with queen-preventing perforations; and these will be kept always inserted when the super is in use.



The latter can be had wholly of *glass* (except of course the frame-work at the edges), or else like the one here shown, which, like the hive itself, is formed of *straw*, but with three windows. It is similar to the stock-hive, but is only two-thirds of its depth, and its frames number eight instead of nine. They are, however, *bonâ fide* frames (as shown through the window in the front of the figure), and not mere bars as usual in supers. An exit is afforded to the bees from the super without compelling them to return to the stock-hive (the outer cover of course requiring to have a corresponding hole). The flight-hole is made wide, but with provision for narrowing (it is shown most clearly in the wooden hive in the preceding figure). The price of the stock-hive in wood or straw is 25*s.*; a straw super is the same, and a glass one 30*s.* (this being provided with complete baize-lined shutters to top and sides).

Those desirous of a *cheaper* article may be recommended to the same firm's "Cottager's Frame Hive," which costs only 7*s*. 6*d*. It is of the same inside dimensions as the preceding, but omits the window and the dummy, while the floor and crown boards are of a simpler make. The frame bars rest upon similar ledges of zinc, but they have not the lengthened ends, and are fixed in position by staples. At the intermediate price of 12*s*. 6*d*. a large window behind may be added to this hive, and a crown of straw substituted for the wooden one. An application for Messrs. Neighbour's catalogue will secure a still further choice.

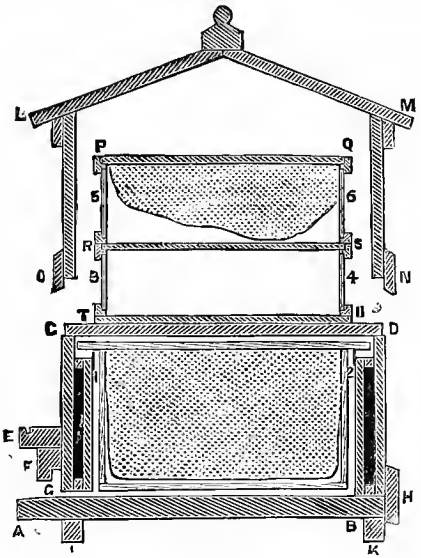
Next in order we have to describe the elaborate and well-known structure called "The Cheshire Hive," which was designed by the Rev. F. R. Cheshire, and is made by Mr. James Lee, of Bagshot. We annex a figure from a block lent us by Mr. Lee, but it is but fair to say that it does not do justice to the appearance of the hive, nor even give a correct idea as to its form—for its body is almost perfectly square, and not so shallow



from front to rear as would naturally be inferred from the sketch. It is a hive which has been fully described not only in Mr. Cheshire's own work, "Practical Bee-Keeping," and in the apiarian columns of the *Country*, to which he is a contributor, but also in Mr. Hunter's "Manual of Bee-Keeping," and in the new edition of the "Encyclopædia Britannica." We need therefore make no apology for proceeding to a considerable extent upon the line of the description prepared by its inventor.

It is one of the hives which carry their own cover and stand—at least as here represented, for the stand can be had in a detached form if preferred, as Mr. Cheshire concludes it will be by the generality of bee-keepers. The body of the hive consists of two main portions—the super-cover and the hive proper. In front of the lower part is the porch, the roof of which, consisting of a stout piece of pine about three inches wide, runs completely along the hive face. This is chamfered off towards the end, the more effectually to carry away drip, and has a channel near its front edge as a gutter to convey the rain to its ends. For many of these particulars we must refer to the sectional view as illustrated by a block used in Mr. Cheshire's frequently quoted volume, and kindly placed at our service by Mr. Leonard Gill, the Manager of the *Country*. In this figure the gutter referred to is shown at E. The floor-board projects two and a half inches in front so as to form a convenient alighting-board, ten inches of the central portion being grooved (see first figure), so that, in case of a driving rain, the convex parts will still give the bees a dry passage to

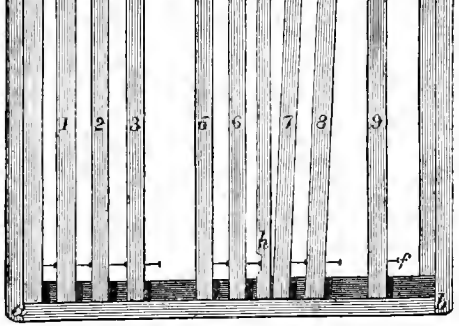
the interior. The flight-hole has the same length of ten inches, and is formed by cutting a full quarter-inch out of the hive wall, instead of the floor. This is shown at G in the sectional view, while F is a piece screwed beneath the porch roof to give it additional stability, and provide a groove for two sliding shutters, by which the width of the entrance may be regulated as desired. Two studs at the ends of these pieces prevent the shutters from meeting nearer than within half an inch, so as to do away with the fear of the colony being accidentally stifled, and also with that of crushing bees by the meeting of the two slides but if the total closing of the hive is from any exceptional reason desired, the doors can be taken out and transposed with each other. The floor-board is movable, and can be drawn out without disturbing the bees upon the combs, the runners upon which it slides being shown in the first figure. In the section, A B represents the floor-board, H a



back piece against which it presses, and I, K two movable bars for insertion between it and the runners, by means of which it is held in its intended position (the runners not coming into use till the board is lowered on to them by the extraction of these bars). By having the legs fastened to the hive proper there is opportunity given for cleaning and returning the board in winter; but on the other hand, when introducing a swarm, Mr. Cheshire considers the independent stand more convenient for the beginner. For this last operation there is a purpose in the bars just noticed, for, by removing the one at I, but retaining the other, the floor-board will drop down in front, and offer to the bees a wide entrance and a sloping floor. The super-cover forms the upper half of the hive in the outside view, and is represented by L M N O in the section. It is hinged so as to open at one side, and is so contrived, by the aid of a chain or a side-stay, that it will fall back just far enough to form a horizontal table, handy to the bee-keeper for supporting apparatus. It moreover carries within it a slate with an attached pencil, for making entry of whatever of note passes in respect of the hive. The legs splay to widen the base, and the roof has its eaves amply projecting.

The sectional view shows the walls of the stock-hive to be *double*, with a space of dead air of their own thickness between them. But the hive is also to be had in *straw*. Blocks above and below the air-space keep the inner sides in position. "As heat is conducted by air with extreme slowness," says Mr. Cheshire, "these means prevent the escape of that generated by the bees during rigorous weather, while

they also exclude the ardour of the sun's rays during summer." The inner wall is made an inch shallower than the outer one, so as to afford a rest for the ears of the frames. These are eleven and of the Woodbury size (fourteen inches long by eight and a quarter deep outside, but exclusive of the ears), and they rest upon strips of zinc which rise three-eighths of an inch from the top of the inner wall, and are shown at 1, 2, in the section. The top bar of the frame is three-eighths of an inch thick, so that when resting upon the zinc it allows a space of a quarter-inch between the frames and the crown-board. The depth of the hive (D H) is eight and three-quarter inches; the measure from front to back (1 to 2) is fourteen and a half, and the width, if with the usual eleven frames and a dummy, seventeen and a quarter. The annexed figure gives a view of the top bars of the frames as in position with three extracted. The dummy (*h i*) is three-quarters of

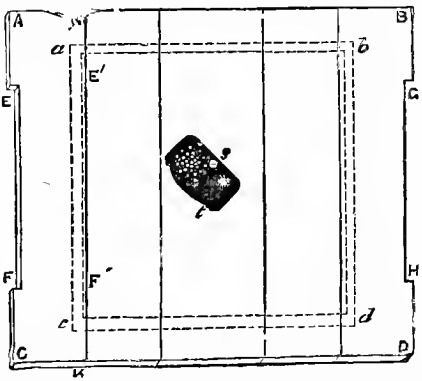


an inch broad, or rather less than the frames; it

usually hangs next to one of the sides of the hive, and consists of a double board the same size as a frame, and having the grain of its respective thin halves running in cross directions to prevent warping or breaking. These are fixed to each other by means of screws of five-eighths of an inch. At *e, f,* on the frame to the right is shown the method of holding the frames at their proper intervals by means of alternate distance-pins. These are driven in immediately above the side-bars of the frames, so that in extracting one of the latter there is no fear of tearing the comb against a pin. The bar is seven-eighths of an inch wide, so the pin projects five-eighths, and thus makes up the total space allotted to each frame to one inch and a half. By placing the two pins upon different sides it will be seen that a frame can be turned round and inserted the other way if desired. As only half the interval is needed between the end frames and the hive wall, there is a hollow cut at *g* on the left-hand upper corner to admit of half the length of the pin; while the dummy, which usually takes the place of the other wall, is similarly grooved at *h,* and this groove must extend from top to bottom of its board, to admit of extraction from the hive without disturbing the next frame. It carries its own pin at *i,* made half the length of the other pins. As the dummy here stands it illustrates the method of contracting a hive when the colony is too small to preserve a due degree of warmth if scattered over the whole: more frames, as fast as they are required, must be inserted in the *centre* of the occupied ones. To enable the dummy to be placed close up against the right wall of the hive, it

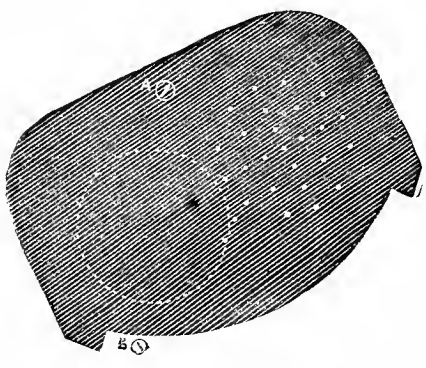
has itself no pin upon that side, and hence, when displaced as above, there is nothing to keep the next outer frame from touching against it at one end. Indeed, when in this position it is necessary that they should thus touch, for otherwise the distance-pin on the eleventh frame (at *f*) would prevent the full number of frames being retained in the hive. At the right-hand corners, *d* and *b*, it will be observed that the depression over which the frames project is extended so as to give finger-room for the easy extraction of the dummy; but the inner side-wall of the hive, against which this would naturally rest (the interior piece between *d* and *b*), is on the same level with the outer wall, though it hardly appears so in the figure. Within the hive there will be a space of a quarter-inch from the frame to the wall and floor, as directed on page 88.

The next figure represents the arrangement of the roof of the stock-hive, which is both crown and adapting board in one. In the sectional view it was shown by C D. It consists of five strips or slats, clamped at their ends to prevent warping, and each seventeen and a half inches long. The width of the central one is five inches, and that of the others

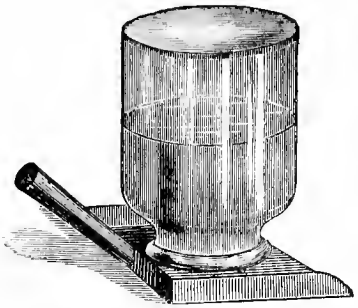


three and three-quarters. The central one contains a hole an inch and a half in diameter, and over it is placed a feeding-stage, consisting of a plate of vulcanite pierced with fine holes, and rotating on the screw *s*, as will be more clearly explained below. At E F and G H the board is cut away to a depth of a quarter-inch and for a length of ten inches, and when the super is in use the two outer pieces are transposed severally with the two next them, so that the two slits will fall within the super, the position of which is marked by the double dotted line *a b d c*—the slit E F, for instance, being brought to E′ F′. While remaining as in the figure these slits fall outside the hive, the total width of the five boards being twenty inches.

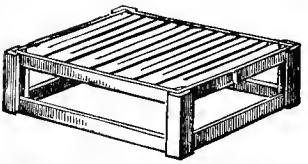
The arrangements for feeding are shown better by the following two illustrations. The first gives an enlarged representation of the vulcanite feeding-stage, A being the rotating centre, and B a stop to prevent the plate from being pushed too far. If the feeding-bottle, inverted as in the second cut (the shovel is simply a convenience for carrying and depositing it), be then placed over the dotted circle, which represent the position of the central opening in the crowns, it

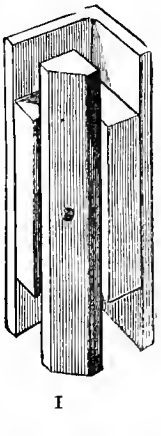


will be evident that the bees will not have access to the food at all; but if the plate be now shifted further to the left, any portion desired, or the whole, of its perforated part can be brought over the opening, and the rate of feeding regulated as desired.



The supers are shown in the sectional view at P Q R S T U, and they are Mr. Lee's own "Crystal Palace Prize Supers." Not being intended to cover the whole of the stock-hive, they measure about thirteen inches square; their depth is four inches. They have seven bars of the extended width usual in supers, the slits shown in the figure being for the admission of strips of wax-sheet. No form of crown is required, as the openings between the bars are closed by Stewarton slides, which, as explained on page 97, fit closely between them, so that when all inserted they give to the entire top surface the solid character of a crown-board. The sides are of glass. The whole can be taken to pieces and packed as a small parcel with the glass inside. The second cut shows one



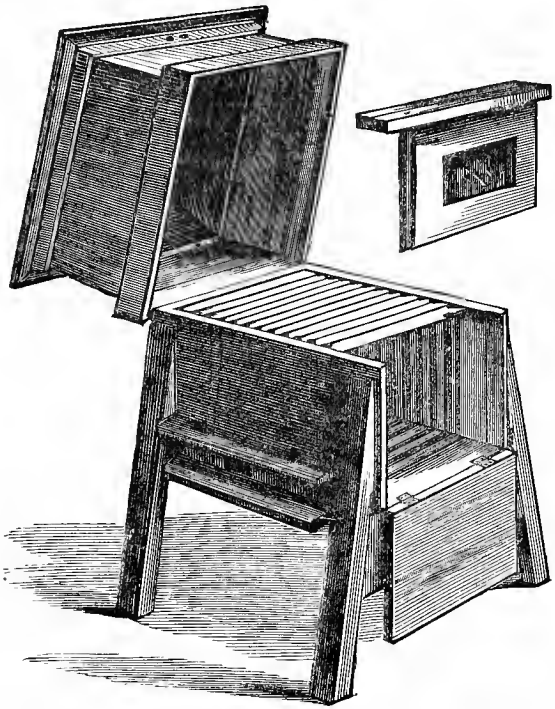


of the corner pillars. Of course only one of these supers is to be applied at first; the second, as usual, being placed *beneath* this when it has become in good part filled, and there is prospect of a sufficiently good season to require the two. "In shallow supers," says Mr. Cheshire, "bees start more promptly than in deep ones, while they ever strive to close up gaps; hence the advisability of having two."

In *outside* dimensions this hive is about twenty-four inches wide by twenty-two from front to rear, while from the ground to the eaves it stands three feet high. Its cost when fixed to its stand is 37*s.* 6*d.* painted, or 45*s.* grained and varnished; with ordinary floor-board and no stand it is 27*s.* 6*d.* These prices all include the pair of Lee's supers, which sell by themselves at 5*s.* 6*d.*, or 3*s.* each. The hive and the supers each obtained for their inventors a first prize at the Crystal Palace Bee Show in 1874.

The full particulars from which most of the above is reproduced have been avowedly designed by Mr. Cheshire for the benefit of those who wish to make for themselves. It is scarcely necessary to state that in so doing they will not be compelled to tie themselves to the Woodbury depth and length, nor even, if they do not incline, to any one particular external figure. All that is essential in the above will readily adapt itself to several variations, and in fact the improvements introduced by the Cheshire hive have furnished the type from which the best adaptations of other English makers have in a large degree taken their start. The trade, with scarcely an exception, will cheerfully admit this fact.

Underneath is given a representation of one of the most complete of Messrs. Neighbour's frame hives—that termed by them "The Philadelphia Hive," from the fact of its having taken a prize at the Exhibition in that city in 1876. The following description is given by its makers:—



"The distinguishing feature in this hive is the facility afforded for taking out the frames of comb while the super is on. There is a movable side to the stock-hive, which allows room for removal from

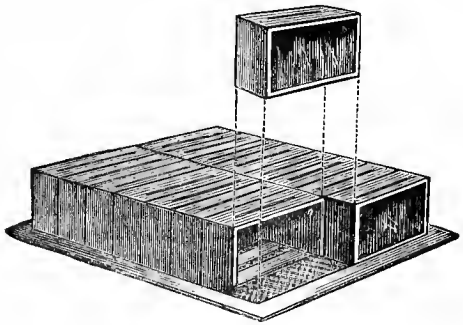
the end; or, if no super is on, the frames can be lifted out on top as with other hives. This movable side or dummy has a window, and there are also windows at the back and on the other side, so that a good inspection can be had. The floor-board, which draws out on the plan adopted by Mr. Cheshire, projects two and a half inches along the front, thus forming a convenient alighting-board. There is an entrance nine inches wide, and the space can be lessened by two sliding shutters. The crown of the stock-hive is of straw and wood, with a feeding hole.

"Our new sectional or divisional supers are used on top, and when these are put on, a zinc adapter, perforated all over with holes too narrow to admit the queen or drones, takes the place of the straw crown. The stock-hive contains twelve of our enlarged-sized frames. The upper part of the cover falls back on hinges kept in position by a wire or chain; it opens at one side, as does the stock-hive. The hive with its cover is complete without any further protection from the weather, and it carries its own stand. It was very highly commended at the Alexandra Palace Bee Show.

"Its size outside is twenty-five by eighteen inches, with a height of twenty-four; the stands are [an additional] eleven inches. Price, complete with sectional supers and zinc adapter, 42*s*."

To the above account, which we have pieced together from the descriptions in "The Apiary" and in Messrs. Neighbour's catalogue, we may suitably append a figure of their "Sectional Super" (their "Divisional Super" is displayed inside the opened

cover on page 121). This may be called a series of boxes, each measuring seven inches by four by two, and designed so as to enable any single portion to be removed and replaced as fast as it becomes filled with honey; of which it will contain about two pounds. In the figure there are shown fourteen of



these boxes, but the above hive will take eighteen. There are glass sides to those that stand at the ends, but beyond this there is no manner of partition between them, so that the whole fourteen sections form practically two supers standing side by side. That side of each section which rests upon the adapter is necessarily cut down considerably in width, so as to afford space for the free admission of the bees from below. The saw cut in the crown is for the insertion of wax strips, so that the boxes themselves thus constitute their own bars. "It is desirable," says Mr. A. Neighbour, "to provide against the admission of cold through the numerous interstices by keeping a warm woollen covering on the top and

pasting paper over the divisions—which can easily be cut through when the super is filled." The price for the set of fourteen is 4*s*. 6*d*.; the perforated zinc adapter, 2*s*.

The "Divisional Super" is on the same plan, but not divided midway. The divisions are attached together by lateral strips of wood, but capable of separate removal by undoing the fastenings. In order to allow of the use of two supers at a time, the lower set have passages cut in the top board. A set of seven occupy the same space with fourteen of the sections above, and sell for 3*s*. 6*d*., or 6*s*. 6*d*. the double set.

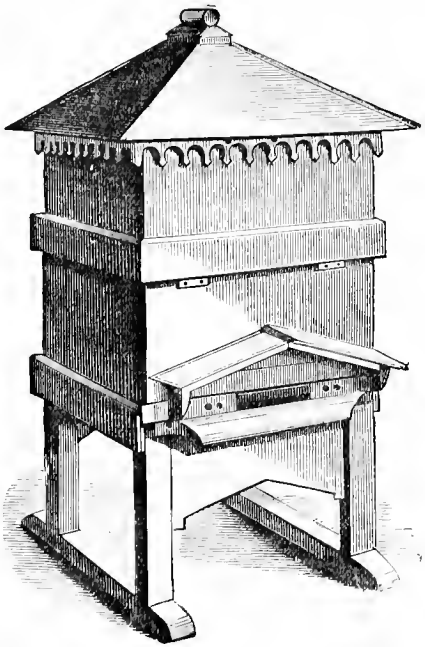
Mr. T. W. Cowan, of Horsham, has introduced a sectional super consisting of smaller boxes than the above, inasmuch as they contain only one pound of honeycomb apiece. They are further distinguished by possessing a separator of glass between each box and the one next it, thus preserving the combs of an even thickness. This form of super was exhibited at the Alexandra Palace Show in 1875; and together with it Mr. Cowan displayed a set of sixteen sections made of tin and enclosed in a box lined with felt. The same gentleman has produced several inventions for the advancement of apiculture, seeking from them no personal emolument: one of these, his "honey extractor," we describe further on. His maker is Mr. Lee, of Bagshot.

Mr. Lee has also sent us a sample of a sectional super of his own, which he calls "The Kensington Sections." A complete double section came by post for 2½*d*., and formed a package smaller than that of an ordinary newspaper. The longer side measures eight

inches in length and the ends four, and as these are attached by tape glued round the edges, they fold backwards flat as on a hinge—the fourth side, which has to rest upon the adapter, being represented by a narrow spline extending underneath each comb, and fitting into notches in the end pieces. It follows from the above that the height here too is four inches, while the breadth is one and three-quarters to a comb. As explained in Mr. Lee's letter, these sections are usually sent out in pieces to hold four combs, so that the complete super holding sixteen combs, equivalent to eight frames sixteen inches long, is comprised in four portions, making up a super of sixteen inches by fourteen; moreover, by means of deep saw cuts extending all round, they can be further divided with a pocket-knife into eight or even sixteen sections. Other saw cuts within give admission for wax guides, and yet a third set is made for the insertion of panes of glass at the ends. Being constructed of plain quarter-inch deal, the entire super, as above described, costs only 2*s*. It is expressly designed for "those who go in for profit."

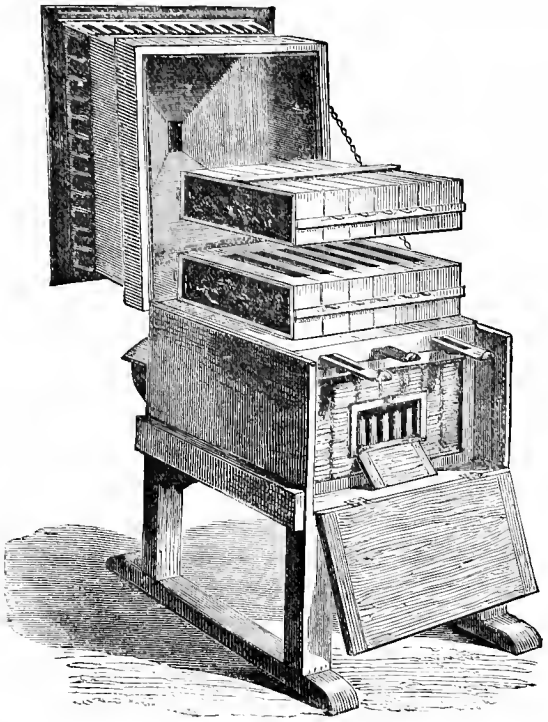
As many hives are sold apart from any outer coverings, it naturally follows that there are several covers to be bought independently of hives, and in general adapted to almost any of these that may be chosen. There is the one known as "The Woodbury Cover," which in general form and construction is a close resemblance of the one of Mr. Taylor's described and figured at page 100. The two following are respectively front and back views of an elegant cover sold by Messrs. Neighbour. Unlike

the Cheshire and Philadelphia hives, its hinged portion falls back over the flight-hole, instead of at the side—an arrangement which is by no means an essential in every case, but practically important



when the stock-hive has one window, and one only, and that one behind; again, it is indispensable to the side opening that the hives in the apiary should have plenty of room between them. The two figures sufficiently explain the construction of the cover before us—the portico, slides, and alighting-board in the first, and the chain and falling flap in the

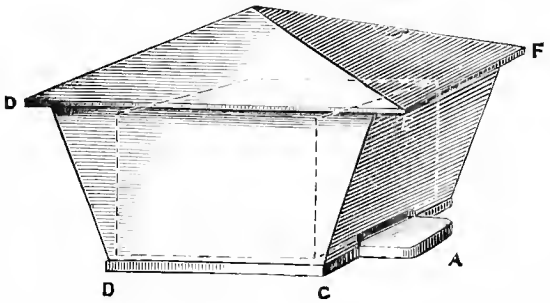
second. The upper part is high enough to admit of the two divisional supers standing one upon the other (the stock-hive shown being the same as the one



beneath the super on page 104). The cover takes apart from the stand. The total height is forty-five inches, the width twenty-two, and the depth from front to back, twenty-six. The price of this cover, grained and varnished, is £2. It is recommended to place bricks beneath the feet to preserve them from rotting.

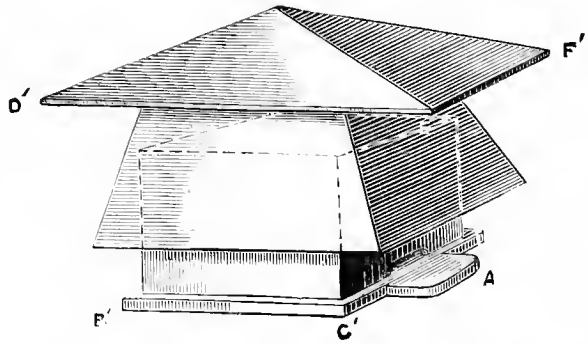
A cheaper cover sold by the same firm is identical in appearance with the one enclosing and forming a part of the Philadelphia hive (page 115), excepting only that it opens from behind, that is to say, the hinges are over the flight-hole as with the above. The price of this is 27*s*.

The two following views represent a much simpler form of cover—that known as the "Hayrick Cover," and made by Mr. Lee. The former illustrates the mode of using this covering in winter time, and the latter in summer. The following is Mr. Cheshire's description: "The dotted lines indicate the hive, of



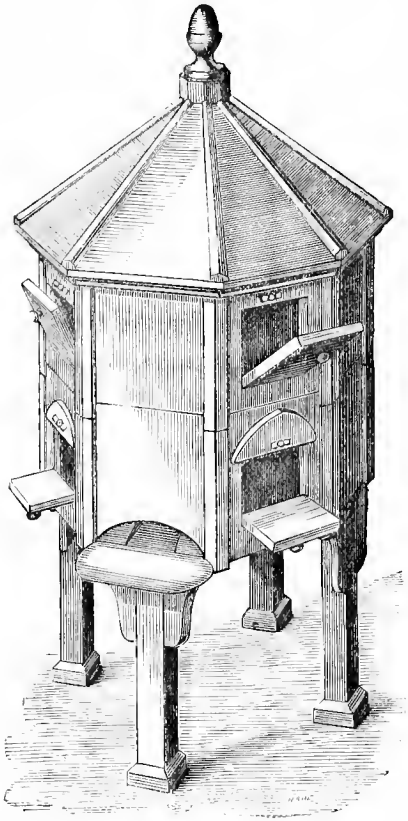
which A is the alighting-board, and B C the bottom board. The case consists of four sides, which should not be less than two inches wider than the height of the hive; these are arranged like the sides of a wheelbarrow, and are each about five inches wider at the top than at the bottom. A roof, D E F, consisting of four triangular pieces, completes the whole. This is merely lifted on and off, and however rough the work-

manship, it may be made perfectly rain-tight by adopting the plan recommended for the cheese boxes"



—which consisted in brushing hot pitch over the bottoms (which form the *tops* of the covers), as well as for one or two inches down the sides; then spreading a sheet of newspaper evenly all over, and applying a hot iron till the pitch is re-melted and thoroughly incorporated with both the wood and the paper. Mr. Cheshire then proceeds: "The case being put on, shaving, rag, hay, or straw is stuffed in between it and the hive, giving a protective covering not to be beaten; over this the roof is placed. For the summer the case is inverted, four little blocks fitted on the inside, enabling it, by two wooden bars, to stand as in the second figure. Under the roof comes the super, while the hive is admirably screened from the sun, and the alighting-board from the rain; and near swarming time, when the bees are clustering outside, they re-

ceive that shelter which many more costly covers could not afford." This cover is sold, unpitched and unplaned, by Mr. Lee at 7*s.* 6*d.*



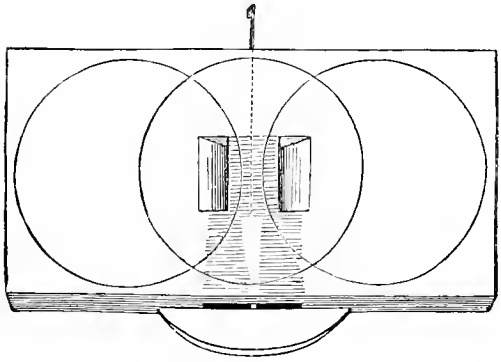
The last of our illustrations exhibits the cover prepared specially for Mr. Lee's octagonal hive (figured at page 65). It is made in three compartments, with opening shutters corresponding with the windows in the hive and super. Its height is thirty-two inches, and its cost 32*s.* 6*d.* painted.

Reference might also be made to various forms of covers in zinc, that adopted with the Carr-Stewarton Hive being especially picturesque. The apiculturist has in fact unlimited scope for the introduction of the ornamental element. But there is another side to

the question, and confessedly all such appurtenances of the apiary, however admirable from an æsthetic point of view, are forbidden to the man who follows bee-keeping for a profit, and concern him only whose hives, like his hot-houses, are a "thing of beauty," and a source of recreation.

COLLATERAL SYSTEM.*

Various modes of working hives collaterally, or side by side, have been devised, but a very simple one has been practised with success by a correspondent, which as adapted by me may with propriety be termed a *doubling-board*. It is formed of a plain board not less than an inch thick. It must be of sufficient width to



take a broad shallow hive, and long enough to contain two of these, with six or eight inches to spare.

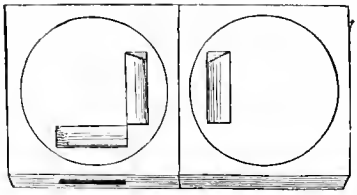
* The first portion of this section is from the last edition.

A stock-hive is in the first instance placed over the central circular mark, within which is the double outlet for the bees. When more space is required, the hive must be moved over one of the side circles, and a second hive placed over the other. The double outlet forms a communication within the floor-board from hive to hive. The part hollowed out for this purpose is five inches wide, six inches long, and half an inch high inside, a sloping way being cut on the two further sides down into it. Two covered passages lead from this, terminating at one point on the alighting-board. The bees, having been accustomed to both these passages, will commonly take to the second hive, and commence working therein, particularly if it be smeared with honey. In order to show the position of the parts hollowed out, these are slightly shaded in the engraving. They are cut from the bottom side of the board, in the way described at page 76. A second piece of wood, nine or ten inches wide, must be screwed to the under side, to enclose the openings. This ought to reach back nearly the width of the upper board; at the same time projecting far enough in front to form the alighting-place. Another cross-piece may be screwed to the under side, at each end.

When it is required to take away one of the hives, the communication below must be cut off between them. This is done by means of a divider of strong tin, copper, or iron, pushed in from behind, in a groove cut edgewise in the bottom side of the main board, and resting on the under one. The dotted line in the engraving shows the position of the divider, which must in depth be the same as the passage

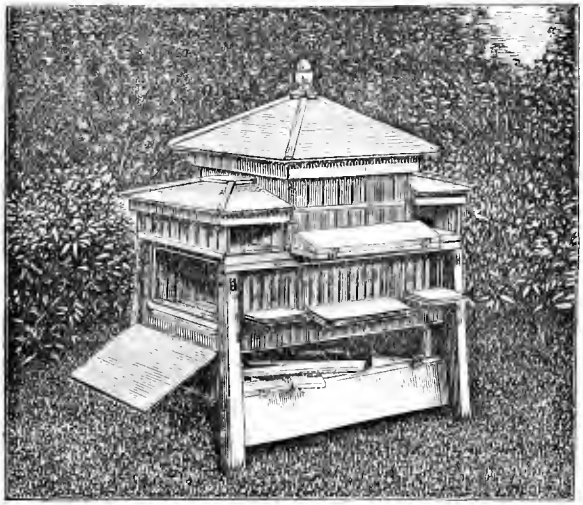
between the two hives, so as, when in its place, to stop it entirely across the centre.

Another plan of working hives side by side is shown below, two boards being required. They are made on the double plan, as described on page 76; alike in size and thickness, with the entrance passages cut out from beneath. There must, however, be two entrances to the board intended for the second hive—one in front and the other at the side, with doorways not less than six inches wide. A wedge or two of wood will contract them as needed. When room is required, the first board with its hive must be moved so far sideways that the second can precisely occupy its place. At the same time it must be turned half round, so that its mouth and that on the side of the new hive meet and fit close together. The bees will pass into the other hive on going out; on returning it will be the same, for the alighting-board (which ought to be a fixture) will remain as usual. On removing a full hive, the other must be restored to its original position.



"Nutt's Collateral Hive"—a wooden bee palace, with central pavilion, octagonal cover, and two wings—is still occasionally met with; but it has wholly ceased to be recommended, and indeed the entire collateral system had all but become a thing of the past, when quite recently an inclination to make further trial of it sprang up in the apiarian world. Messrs. Neighbour

have just announced a "Philadelphia Collateral Hive," with two additional frames on each side of the brood-combs. Other adaptations will doubtless follow. We here present an engraving of the "Alexandra Prize Collateral Hive," from a block obligingly prepared for

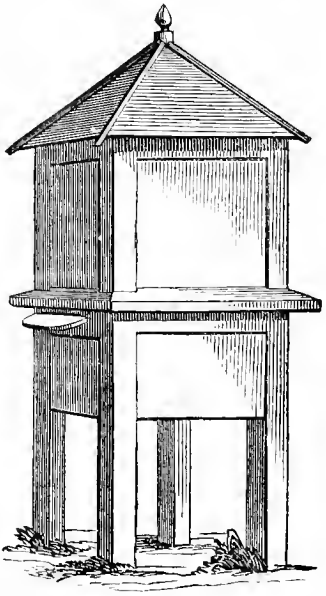


us by the inventor, Mr. J. M. Hooker, of Sevenoaks; but as he unfortunately has been prevented by engagements from supplementing the block by a description, we are compelled to leave the illustration to speak as well as it can for itself.

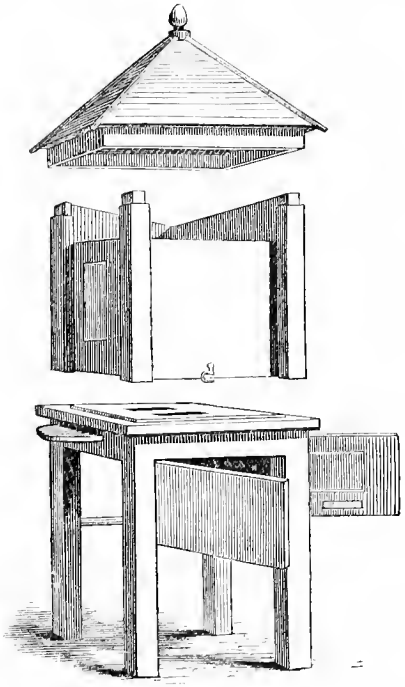
THE NADIR SYSTEM.

There are still many persons who resort to a partial adoption of this system, and we therefore retain Mr. Taylor's directions and illustrations almost unaltered from the last edition:—

Bees not unfrequently take advantage of a hole or crack in the floor of their domicile to commence building combs underneath it, a position possessing some advantages. Deriving a hint from themselves, I contrived what, from this peculiarity, I used to term by way of distinction a *nadir hive*, the store-box being placed underneath the stock, coming out at the back, as a drawer. By way of illustrating the principle and the methods of its application, the engravings annexed will not be without their utility. In practice I found no indisposition on the part of the bees to enter and work in the store-drawer, into which they have access through the floor-board above, and which is in part made like that shown at page 125. It will be seen that the entire design supposes an outdoor hive, with

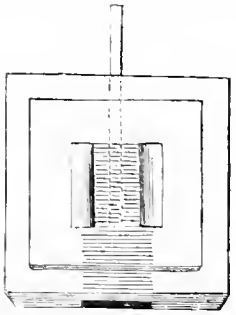


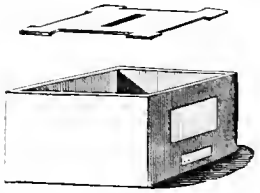
a hipped cover. The stock-box is enclosed by four panels, moving up and down in grooves or rabbets cut in the corner pilasters, the latter being attached to the box.



This mode of applying the nadir, or rather *nether* principle, must not be confounded with the usual plan of disturbing the stock-hive for the purpose of placing an empty one beneath it, with a new entrance in the latter for the bees. Under such circumstances the queen will commonly descend and breed in the nadir,

which is converted into the stock, occasioning much subsequent inconvenience. I have not found such to be the case where the stock, and the entrance into it,





are not interfered with; and am inclined to believe that this adaptation of bottom-hiving is worthy of much more attention than it has received—to say nothing of its simplicity, safety in management, and obvious convenience to the bees. I will therefore proceed to show in what way it may be made generally applicable to the purposes of an apiary.

We have just pointed out that the mode we are now discussing differs from the nadir principle, and by way of distinction, the term "nether" will be used, not only to mark the difference, but as presenting a contrast to the opposite word "super."

We are to suppose that the shelf on which the hives are ranged in a bee-house is perforated under the centre of each, from back to front, with an opening through, three inches long, and about three-quarters of an inch wide. The hive-board must be a separate loose one; and it ought to lie flat on the

shelf, with a perforation similar to the other, the holes in both coming together: to ensure this the shelf can be marked. By moving the hive-board (which is best square) a little sideways of this mark, the position of the two holes is altered, and the communication downwards becomes stopped; always doing this cautiously, to avoid injuring the bees. Or the same object is perhaps better attained by means of a narrow zinc or tin slide, inserted from behind, between the two boards, and moving in a groove ploughed its own thickness out of the shelf. A reference to our last engraving sufficiently exhibits a box, or rather drawer (of suitable size), which, when in its place, moves close on the underneath side of the bee-house shelf by means of blocks and runners; drawing out at the back by a handle. It may have a window and shutter, but no entrance for the bees, except downwards through the cover, in which is an aperture, corresponding in size and position with those in the boards above it. It will be seen that the cover of the drawer is a movable one, of half-inch board, fitting down flush into it, and resting at the four corners upon wire supports, or small blocks, placed the thickness of the cover across the angles. The edges of the cover (except at the corners) are cut away just enough to admit of passing a knife-blade down, to separate the combs from the sides, when the whole may be lifted up, with the combs attached. The honey thus obtained is of the purest kind,* and I have known a large

* The use of queen-preventers will of course make this far more certain.

quantity made available with the least possible disturbance to the bees on removal. The drawer may be sometimes further made useful for the purpose of feeding, a trough being placed in it, close up to the opening in the cover. A small opening or perforation, at or near the bottom of the drawer, will give ventilation should it be needed.

With a further view to facilitating the practice of under-hiving, when favourable circumstances allow of it, we will proceed to describe what I have termed a *nether*, which may be used as an adjunct to a straw or any other hive, as shown in the illustrations, Fig. 1 back and front. It may be of half-inch wood, eleven or eleven and a half inches square within, and six to seven inches deep, as circumstances require (see Fig. 4, next page). It has a window and shutter at the back, but neither a fixed top nor bottom, these being movable boards, of half-inch wood, made to project half an inch beyond the nether box; except that, as respects the bottom board, the projection is increased at the back, with a view to giving facilities on the removal of the nether (see Figs. 3 and 5). To receive and enclose the nether,

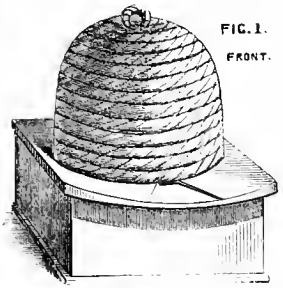


FIG. 1. FRONT.

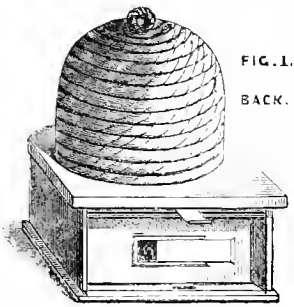
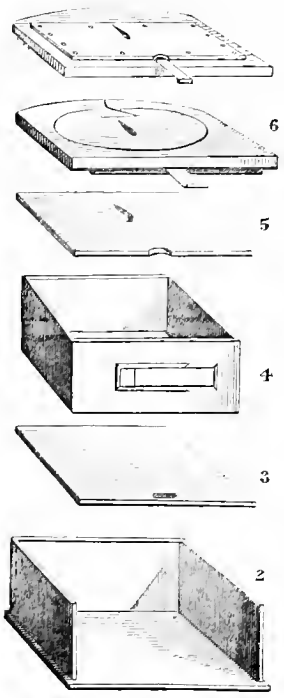


FIG. 1. BACK.

there is an outer case or cover, also of half-inch wood, thirteen to thirteen and a half inches square within-side, made half an inch higher than the nether, its top and bottom boards inclusive. The outer case is closed on all sides except the top and back (see Fig. 2). Upon it rests the floor-board of the stock-hive, which may be of inch wood, showing a projection all round of an inch, except at the front, where an additional three inches is given to form the alighting-board, this part bevelling forwards. A square of half-inch wood must be screwed to the under side of the floor-board, of a size to drop easily within the square of the outer case, thus retaining it in its place. Between the two pieces of which the floor-board is composed, a groove is ploughed out, from front to back, two inches wide, to receive a zinc dividing slide, pushing in from behind. An opening, about three inches long, is cut through the floor-board, towards the front, and also through the cover of the nether, to correspond, so that a passage for the bees can be opened on withdrawing the divider (see Fig. 6).

FIG. 6. BACK



A reversal of this proceeding enables possession or inspection to be had of the nether box, by withdrawing it (upon its bottom board) from behind, the stock-hive being entirely undisturbed by the operation.

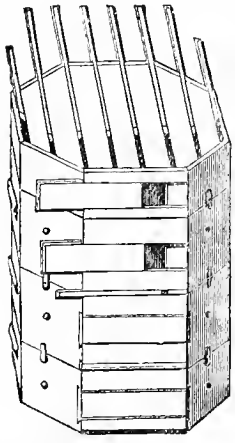
It is well here to remark that experience has shown that it is seldom expedient to apply the nether principle to any but strong and populous stocks, and especially in any other than moderately warm weather, as the bees would then prefer to follow the warmth upwards into a super. On their first admission into the nether, a few bees will often be lost in consequence of their inability to find the way out, so that, as a precaution, a frequent inspection of the window is at such time desirable. A small aperture behind, at the bottom or side of the nether, may be made, as a mode of exit for the prisoners, to be closed at pleasure.

THE STEWARTON SYSTEM.

The well-known "Stewarton Hive" embraces the principles of both nadir and super. We will first extract the brief description given in Mr. Shirley Hibberd's "Rustic Adornments:"—

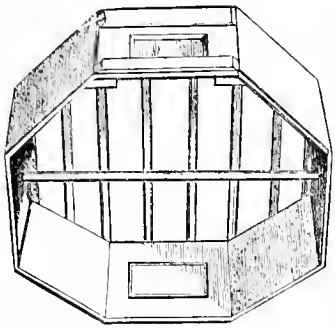
"This hive is so called from the district of Stewarton in North Britain, where it is in general use. It consists of a series of octagonal boxes, four in number, three of them formed exactly alike, but the fourth, which forms the summit, is a little shallower than the others. The inside measure of each is thirteen inches and three-quarters from side to side, or

from back to front; the height of each of the three lower boxes is five inches and three-quarters, the bottom open in all. With the exception of the top or shallow honey-box, the construction of each is the same; the roof is flat, and consists of seven fixed bars, each one inch and a half wide, and between each two bars are grooves three-eighths of an inch wide, which are capable of being closed by strips of wood. When the boxes are severally placed above the stock, these slips are withdrawn, to allow the bees to ascend, and they are prevented from escaping at the openings outwards of the grooves by little blocks of wood fitted in at the back of the hive. The two lower boxes have an additional *cross-bar*, to give strength to the combs.



Each box has a window back and front, closed by a movable shutter, and every one of the three larger boxes may be used as a stock-box by the withdrawal of a slip of wood from the front, which immediately forms an entrance for the bees to come and go. The swarm is hived into two boxes joined and communicating with each other. When these are filled, the super or honey-box is added. As more room is required, another of the large boxes is added *below* the stock, the original entrance is closed by a slide, and a new one opened by a similar slide in the nadir. In the winter this lower box is removed, and the combs left in it undisturbed for

the future use of the bees. The boxes are readily adjusted by means of buttons, and each has a set of hooks attached to give facilities for lifting and weighing.



"In a communication received from one who has had large experience on the Scottish moors with these hives, he says, 'In a good season I have known a skilful hand take honey to the value of six or seven pounds sterling from a single hive, besides leaving an ample store for winter.'"

In the two figures the broad white spaces on the top of the hive must be taken for the bars, and the narrow and partially shaded ones for the slides, or else the grooves in which these move. In the first figure these are represented as partly withdrawn, and projecting over the back of the hive. The arrangement by means of which the bars and slides fit so closely together was shown in section upon page 97. The "little blocks of wood" by which the openings are closed when one of the slides is removed are technically known as "sectional slides." These hives are made in Scotland by specially-prepared machinery, and it will be a formidable affair for the bee-keeper to construct one for himself; the Scotch maker, however, does not send out floor-boards with them. The three stock-boxes contain nine bars to the seven which

the cuts show in the super, but all are alike immovable and fitted with intervening slides. The super is only four inches deep.

Special instructions are needed for the use of this complex structure. The two middle boxes are tied together by the aid of the projections at the sides, the slides in the lower one are all withdrawn, and the sectional ends inserted, and the whole can be then reversed and receive a swarm in the usual way. In about a week (some do it on the same day) a second swarm is hived into the lowest of the four boxes, which is kept separate, but close by the side of the two others, till dusk, and the latter together are then placed on the top of it, when its slides are removed and the openings closed by sectional slides, as just explained in the case of the other box. The new swarm will pass upwards and join its predecessor, and on the following morning one of the queens will pretty certainly be discovered dead before the hive.

But the lowest box is not to be brought into working use just yet, and now that the bees have deserted it and gone higher it is at once withdrawn. In a very few days, if the weather is favourable, the two remaining boxes will show signs of approaching fulness, and now the *super* is added. Do not withdraw all the slides at the top of the upper stock-box, or you will have the queen passing into the super too freely; but with only one at each side removed, she will be less likely to give you annoyance. The next addition is the restoration of the lowest box or nadir, which is to be effected as soon as requisite, and upon adding this the old entrance hole is closed, and that in the

nadir opened. There are now three boxes in the stock-hive, but if the bees take to storing honey in the nadir, you may open more of the slides into the super, and add a second, and it may be a third super. Indeed, we are told of the continued addition of supers and nadirs till a pile of eight or ten boxes has been reared.

The supers as filled will successively take their departure in the same manner as other supers; and as the cold weather approaches, the nadirs must be removed too. The two original stock-boxes will then remain well wrapped up through the winter.

The maker of this hive is Mr. James Allan, of Stewarton, Ayrshire; but it can be obtained through other dealers at a slight increase in price to cover carriage. Messrs. Neighbour quote the price of 21*s.*, including a floor-board. This is for the four regular boxes, additional ones being extra.

Octagonal hives possess one theoretical advantage over square ones in the fact of their being a much nearer approach to the circular form, which naturally is the one in which the interior warmth is most uniformly diffused, with a freedom from cold corners. The gentleman known as "A Renfrewshire Bee-Keeper" claims this as an important advantage in winter time, and doubtless the balance is on its side. But the universal desire for the application of the *frame* system will long continue to obtain the preference for square hives in which the frames can be freely transposed. The gentleman just named has partially met the objection by an adaptation known as the "Renfrewshire Stewarton," in which all the

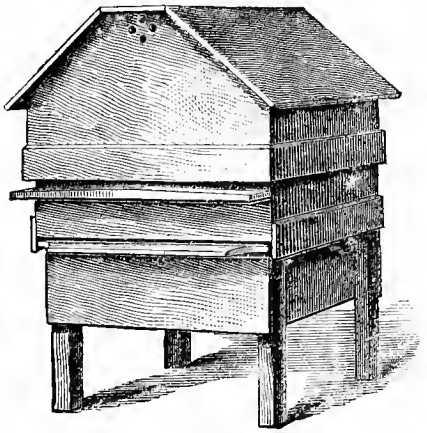
bars are movable, and the four central ones (those of full length) have frames attached. Many, however, will give preference to the form of the "Carr-Stewarton Hive," which, if it had no other point in its favour, might well claim our notice from its forming the *prettiest* home for bees that has perhaps ever been constructed. Its inventor is Mr. C. W. Smith, and its maker Mr. James Lee, who supplies with it a circular containing full particulars of its structure as well as its mode of use. It is made of straw, with wooden frame-work, and a picturesque zinc roof. The two stock-boxes, which are fifteen inches square and six deep, are each furnished with nine frames made slightly wider at top than at bottom with a view to giving greater facility for extraction. From the greater capacity as compared with the regular Stewarton, one stock-box becomes sufficient for starting with at the beginning of the season, that box being the equivalent of the two which are fastened together in the prototype, and the lower one being the nadir to be added when required. The bars of the frames are like ordinary ones, but there is a crown-board furnished with four Stewarton slides, two at each side. The honey-box, which is four inches deep, and wholly of wood, has seven of the old form of Stewarton bars—an arrangement which, one would think, might very well have been improved upon when the other desirable changes were made.

Mr. Smith speaks of the ready adaptability of the stock-boxes to the purpose of *nucleus hives* (as to which see a subsequent section). "As each stock-box," he says, "when placed on a floor-board will form a

separate colony of nine frames, and as only four frames will be required for a queen-raising nucleus, the simple insertion of a close-fitting piece of board in the centre of the box will at once convert it into a pair of nucleus hives, the floor-board being made reversible to form double entrances for that purpose." The price of this hive is 46*s.* or 49*s.* according to the formation of the roof. An adapting-board can be had by those who desire it for 1*s.* 6*d.* extra.

THE DIVISIONAL SYSTEM.

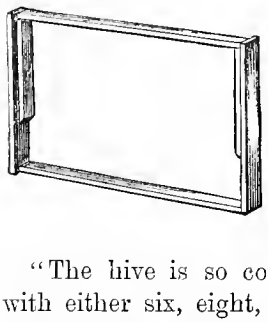
We have already observed the growing tendency to the adoption of this system in the case of supers, and we have here to witness its application to stock-hives. Mr. S. Simmins, of Crawley, Sussex, has introduced a "Divisional Hive" which obtained a certificate of merit at South Kensington in 1878. In its present improved and simplified form it is thus described by its inventor:—



"The 'Divisional Hive' is composed of ten sections (sixteen inches by ten inches outside measure), their

two ends being an inch and a half by three-eighths, and the top and bottom rails seven-eighths by three-eighths; it has also a floor-board, cover, and nadir containing two rows of sections. The nadir, having four stout legs firmly attached to it, is a simple and convenient stand for the hive, thereby doing away with the inconvenience of legs fixed to the stock-hive. The frames with the two end boards rest at each side on a quarter-inch rabbet. The cover is capped with zinc, and is therefore thoroughly water-proof.

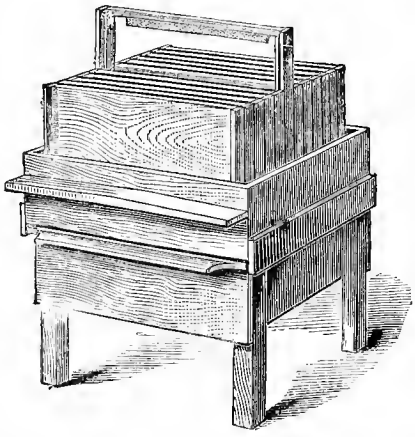
"Although the ends of the frames are an inch and a half wide, they are constructed so as to allow both sides of the comb to go close against the cage of the extractor. As the wide frame ends are worked true, and are all held tightly together, the bees are unable to stick them together with propolis. The frames are perfectly rigid, and held so securely by a simple contrivance at the back, that the hive may be turned upside down without their moving from position.



"The hive is so constructed that it may be used with either six, eight, or ten frames, or more; *either number forming a completely closed-up hive* (of course excepting the entrance), thus economising heat by allowing it to be enlarged or reduced according to the requirements of the swarm. For wintering, a stock may be deprived of its surplus frames of comb, which may be returned in spring as the bees require

more room. By taking out the wedge and back board, a large space is left for drawing back the first frames, thus giving the operator free access to any part of the hive. Having wide ends, the frames will stand on any flat surface without other support. With ordinary care no bees need be crushed between the wide ends; if any be in the way, gentle pressure will cause them to run into the hive.

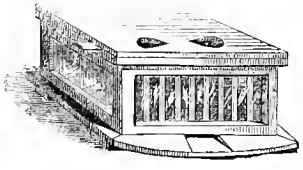
"By using the nadir, the frames are always accessible, thus permitting the examination of the hive while working the honey sections, without disturbing them in the least; neither is there loss of heat, as in supering. The floor-board is divisible, and can be parted at the middle to allow the bees to work down into the nadir. The bees may be induced to take possession of the nadir by taking from the hive several frames of comb, when, being suddenly overcrowded, they will more readily make a start below; and when storing has commenced, the same or other stock combs may be returned to them. There is no crown-board to the hive, it being adapted for the quilt [or of course for the phrail, page 98].



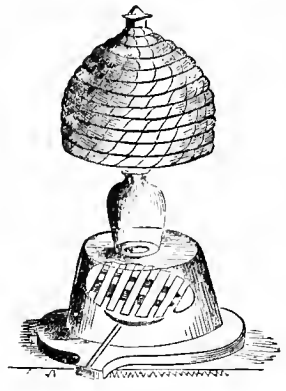
Impressed wax guides are attached to all frames and honey sections. The price is 27*s*. 6*d*. complete."

OBSERVATORY HIVES.

The simplest of these is in form like an ordinary frame hive with its sides composed of glass as in the figure annexed, or more usually now, with the crown of glass also, and the openings into the super cut through this. The hive should be placed in a house and in winter carefully covered; an outer case or box going over the whole —that is to say, if the risk of keeping the bees in such a hive during winter is encountered at all.

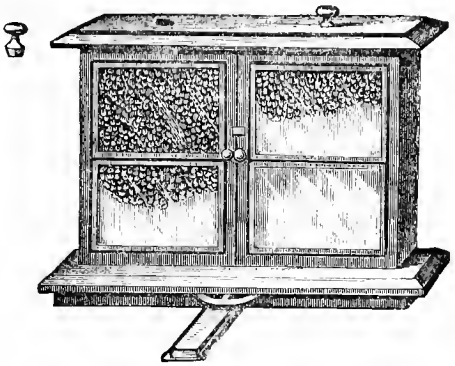


Another form is that of the "Circular Observatory Hive," the general features of which are here shown. This hive is adapted for placing within-doors, a glazed tunnel connecting the entrance with an opening cut through the window-sash. A glass dome or cylinder forms the stock-hive, within which are a number of wooden bars supported by a pedestal and designed for the same purpose as the bars in other hives; an opening admits to a bell-glass super, and, over the whole, a straw skep fits as a cover. Messrs.



Neighbour have a hive of this character, which they term the "Ladies' Observatory Hive."

Lastly, there is the "Unicomb Hive," which, as its name implies, is so narrow that only one comb can be built within it. In form it is a glass case, glazed upon both sides, and in consequence the bees, including the queen, can scarcely ever get into a position in which they are not fully exposed to view. Such hives, if well screened and covered over, may be placed out of doors, but they are better adapted for standing in a conservatory or drawing-room. In such position of course the tunnelled entrance is required as described in the preceding paragraph. The figure represents Messrs. Neighbour's "Indoor Unicomb," price £3 10s.



It is far safer to restrict the use of glass hives entirely to the warmer weather, removing the colony into wood or straw upon the first approach of winter. Even inside a parlour the glass is almost sure to become at that season so chilled as to render the preservation of the bees a difficult and even doubtful task.

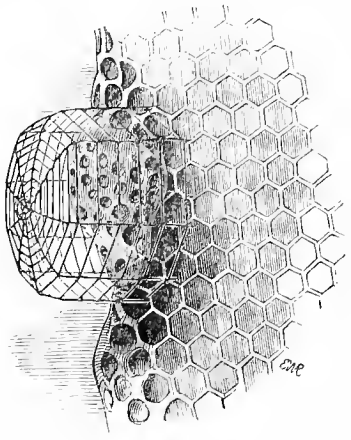
NUCLEUS HIVES.

The object of these is the rearing of young queens with a view either to Italianising or other substitution, or to the starting of artificial swarms. This process may be carried on in ordinary hives, but it is safer to conduct it out of the reach of the old queen, and, when special hives are appropriated to the work, there is an obvious convenience in using those which are so small as to require but a few bees to maintain the requisite degree of warmth. Mr. Cheshire's nucleus hive is widely known and commended. It measures only three and three-quarter inches in width, and seven and a half from front to rear, its depth being nine inches. It thus contains only two frames, and these are constructed with a tongue in the top bar of the one and a groove in that of the other, so that, when taken out of their own hive and placed end to end, they can be fitted together, and constitute a single frame of the size of those in the larger Cheshire hive, thus differing from other frames simply in the dividing-pieces down the middle. In this arrangement consists the system of their working. A double frame, thus combined, is placed in the centre of an ordinary stock-hive, until one or more royal cells are constructed upon it. It is then withdrawn with such bees as it contains, only taking care not to remove the queen; the two parts are now disunited and placed in the nucleus side by side, with the royal cells towards the centre. These may, of course, be not all upon the proper sides, in which case it is easy enough to transfer them by cutting out

the piece of comb upon which they are affixed, sacrificing the adjoining cells in order to make sure of not touching the infant princesses. Each cell thus extracted must be provided with a new location by cutting a space for its reception in the assigned spot, and, if necessary, it must then be fixed by a little melted wax. But, as anything approaching to pressure is sufficient, in the earlier stages, to kill the insect within, it is not right to attempt this transfer till the top of the cell shows, by its brown colour, that it is within three or four days of hatching. There is no danger in leaving the whole in the original hive for from a week to ten days from the construction of the first cell; but ten is the extreme limit of safety.

The most certain way of ensuring the preparation of royal cells is to remove the queen from the hive for a few hours; then, if two or three of the divided frames have been previously inserted in the centre, one or more of these will be sure to provide the apiculturist with the object of his desires. The transferring process can, of course, be equally well accomplished from other frames to the one desired; but there is also another resource which does not appear to have attracted much attention in this country at present. It has been ascertained by Dzierzon that, by removing from any unsealed royal cell a portion of the jelly, and placing this within any worker cell desired, the bees will be induced to adopt the occupant of the latter as a princess, and will construct the cell and rear the larva accordingly. This plan is especially convenient when two or more royal cells are placed awkwardly close together.

Another precaution has to be observed when several queens are hatching in a nucleus, for it is well known that the first which comes forth will forthwith proceed, if permitted, to the destruction of all her rivals. One of the queen-cages of the domed construction should therefore be placed over a cell from which danger of the kind is apprehended; this will press down into the surrounding comb, and keep the young princess out of mischief till she is removed to the hive designed for her, when the cage can be shifted to the cell next likely to need it. A similar cage will require to be used if the cell is allowed to remain longer than ten days in the original hive; so protected it may, of course, be hatched there, if desired. The cage must nowhere come actually into contact with a royal cell, and it may be requisite, in consequence, to pare down the surface of the opposite comb.



In Mr. Cheshire's nucleus hive the walls are constructed double, as in his larger hive, but every additional care must be taken to preserve the due degree of warmth. Moreover, as the older bees, which were upon the frame at its transfer, will be certain to desert it and return to the parent hive, it will be needful to take out other frames, and shake the young

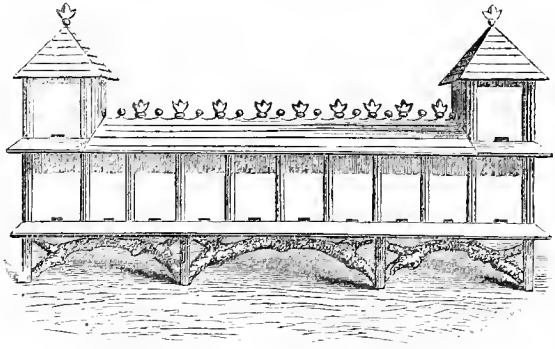
ones therefrom on to a board placed before the nucleus. The entrance-hole must be narrow, as the stock is, of course, one of the weakly kind most helpless against the attacks of marauding bees.

BEE SHEDS AND HOUSES.

Under the head of "Hive Covers" we have shown in what way exposed hives can be protected from the effects of weather; and where only one or two of them are kept, any of these might suffice. The case, however, is altered when a well-stocked apiary is aimed at, requiring a more complete provision for permanent safety. For this purpose, some proprietors like a covered shed or verandah, in a well-screened spot, partially open in the front only. There should be ample space inside for a passage behind the hives, which may be ranged far enough from the front to be beyond the reach of wet and too much sun. At page 79 is given a description of a *hive-range* well adapted for a position like this.

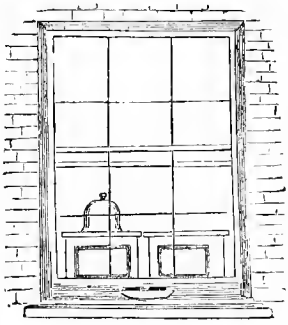
The wooden bee-houses which are sometimes constructed—open in front, and closed altogether behind, retaining the sun's heat as an oven—are objectionable. These are frequently the receptacles of dirt and vermin, and most inconvenient to operate in. It would be an improvement to make them deeper backwards; or with a falling front, moving on hinges, so that the hives can be recessed behind it, away from the influence of weather. At the back should be folding doors, opening from top to bottom, allowing a good access to the hives. For greater convenience, it

is best only to have them in a single row, with good head-room. But a still more desirable plan is to board up the front of the house entirely, making oblong openings through for a passage to the bees, with an exterior alighting-board, a good deal slanted downwards (the bees preferring this to a flat surface). The hives are arranged immediately behind, upon a shelf, the further apart the better, as the bees occasionally mistake their own homes, and fall a sacrifice in consequence; it is now a practice to assist them against this mistake by painting the alighting-boards distinctive colours. This kind of house is capable of receiving some architectural form; and, with locked doors at the back, gives better security than most others against depredation; for hive-stealing is by no means rare in many localities.



A spare room in a dwelling or an outhouse may often be fitted up to serve the purpose of an apiary

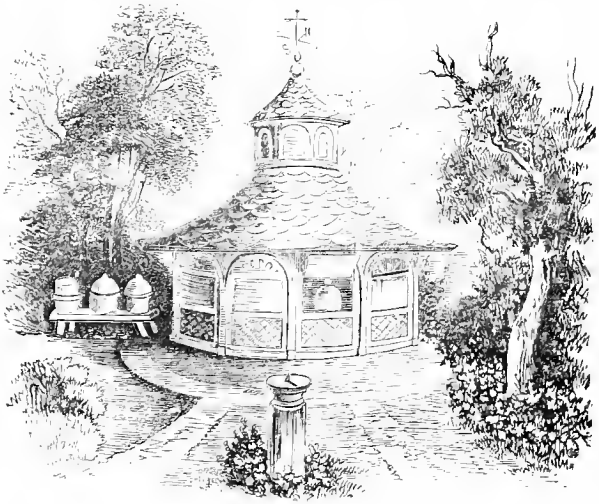
with great convenience; but it should be on a ground floor, as bees placed at a high elevation often fly a long distance before they alight when swarming, or, perhaps, may settle on the top of a tree. A shelf can be fixed along the wall, with perforated passages facing the hives, leading outside. Any space there may be between the mouth of the hive and the wall should be filled up by means of a suitably formed wooden block or covered passage, well hollowed out on the underneath side; admitting the bees freely through it into their dwelling, but excluding them from the room itself, and thus ensuring safety in operating. Even at a common window, I have sometimes placed a stock-hive on a doubling-board; the latter fitting within the frame of the window, which is raised, to admit of its being projected under the lower edge, so that the bees have no admission except to their domicile.



Messrs. Neighbour announce that they keep, or make to order, bee-houses to admit of from one to twelve hives, and doubtless either they or any other hive-maker would be able to meet the wishes of customers in this matter to an almost unlimited range of choice. But the largest house ever planned by our makers seems far outdone by what we hear of in Germany, and the scale of some of the operations in that country may be gathered from the

portentous heading to a section in Von Berlepsch—*Das hundertvierundvierzigbeutige Bienenhaus;* which means, literally interpreted, "The Hundred-and-forty-four-hiving Bee-house." The said house is arranged crosswise like the sails of a windmill, with hives eighteen in a row upon each side of the four arms.

The annexed illustration exhibits an ornamental bee-house, referred to in the following section in an extract from Mr. Hibberd's "Rustic Adornments." The frontispiece to this volume, as well as that prefixed to its second portion (page 171), will also perhaps furnish hints acceptable to some of our readers.



POSITION AND ASPECT.

As regards position, it is of great importance that an apiary should be free from damp, or from the drippings of trees, and as little exposed to the direct influence of the wind as possible, for which end a sheltered nook on a low level is preferable to an elevated one. Moreover, as Columella pointed out eighteen hundred years ago, a low level suits the bees better than a high one when they return laden from the fields. A dry gravel plot, or well-mown lawn, is often to be preferred, and it will be the better if closed in with evergreens, especially the laurel and laurustinus, which are much resorted to by the bees; but the arrangement must always be such as to leave an approach at the back of the hives. Let these not be placed too near water, into which the bees are apt to fall or be blown (though a shallow spring, rippling between pebbles, is rather an acquisition); and it is desirable that they should be within sight of some dwelling-house, to prevent losses in swarming time. The absence of noise and of bad smells ought to be studied; for no sense in bees is so acute as that of scent. Disturbers of any kind, as fowls, dogs, pigs, &c., should be kept at a distance; while the vicinity of confectioners' shops, or such like temptations, is perhaps as serious an obstacle to success as any that could be named. Experience has shown that where bees are very extensively kept, the apiary is best divided on the same premises, so as not to have the whole crowded together—a circumstance often incon-

venient, particularly at swarming time. Nothing high enough to obstruct the direct flight of the bees should be allowed immediately in front of the hives; but a few low plants are rather useful as resting-places, for bees, from fatigue, often fall to the ground just on reaching home, especially in an evening, and numbers in consequence fall a prey to cold, and various enemies. Many lives may be saved by spreading out a cloth or mat in front of a hive when this is observed. Shrubs or bushes, at no great distance, are convenient in the swarming season for the bees to alight upon; and often prevent a longer flight, or collecting on high trees or other objects.

As regards aspect for bees, many and conflicting have been the recommendations according as they have been influenced by locality and climate. So many circumstances have to be taken into account, that it is hard to lay down any rule of universal application, and colonies have been known to prosper in all positions, from due south to north. We know that it has been sometimes advised to turn the hives from the sun in winter, and to screen them from its direct rays in summer: this has led to an opinion that a permanent north aspect is the best; and often it is so. Still local considerations must have their weight, and we are to look to these as regards shelter from cutting winds; the more necessary where no sun reaches the front of the hives. A north aspect need not necessarily be an exposed one in winter; nor at other times one wholly uninfluenced by the effects of the sun. We have recommended doors at the back of a bee-house, by opening

which at proper times, in the case of a north frontage, the sun's rays have access from behind, with sufficiently good effect in producing a genial general warmth. In forming a decision as to aspect, we ought to take into account the position of buildings, trees, &c., for we have already observed that the flight of the bees from the hives should be uninterrupted. Moreover, the kind of house must have its weight in the scale; for where this is one closed at the front from the immediate influence of the sun, aspect is of less importance. Dr. Bevan placed his hives around the interior of an octagonal erection, without perceiving any sensible difference in their well-doing. It may, however, be remarked that, occasionally, in a hive exposed to the earliest rays of the sun, the bees have been prematurely tempted out in the spring months, and fallen victims to the effects of a damp and chilly atmosphere; this objection can be obviated by erecting a screen of matting before the hive in winter time.

To these remarks we may append a somewhat lengthy extract from Mr. Shirley Hibberd's "Rustic Adornments," which in great part has reference to his own apiary at Stoke Newington, of which an engraving appears in our frontispiece. It will be observed that he differs from Mr. Taylor's remarks above in advocating one definite aspect to the south-east.

"It is by no means an easy matter, even in a garden of considerable extent, to find a suitable spot for a bee-shed. This for several reasons, which must have consideration in the first instance. The bees

must have a clear way out; there must be no traffic within at least half a dozen yards of the front of the hives. It must be confessed that at Stoke Newington for twelve years the bees stood with their faces towards the principal walk, and only about eight feet distant. But at honey-taking times we used to prohibit any one but ourselves going into the garden, and if visitors arrived they gave but little trouble after being admonished that the bees hated strangers after they had been robbed. Any way there ought to be no traffic near the front of the bee-house; the bees must have an open causeway out and home, and they must look east, south-east, or south. Ours stand now facing south-east with an open causeway where traffic is impossible, with half a mile at least of meadow land full before them, before they can reach any pathway or public road. It is not because bees are dangerous that this rule of an open causeway should be observed. When the honey is taken, they make it known, if any opportunity is afforded them, that they have just a shadow of a temper, and power to demonstrate the fact. At such times strangers should be kept out of the way, and if the apiary is so placed that strangers cannot be kept aloof, then all that remains to be said is that the apiary is badly placed. On all ordinary occasions bees have not the least idea of stinging; in fact, a bee going about her business must be annoyed considerably ere she will waste her time to punish the enemy. So in taking a swarm, it may almost be said they will never sting: at all events none but a bungler or a very timid person will be stung by them. Give them a good causeway then, not looking on a

croquet lawn, or a much frequented path, or where any kind of labour is customarily performed.

"Another requisite of a good position is ample space for approach in the rear of the hives. The apiarian will, let us hope, have heavy weights to lift, and sundry small mechanical operations to perform, for which he must have room for the free use of his limbs. When a swarm has been taken, it should be brought in at the back of the shed, and be placed on the stand where it is to remain; it is a most improper procedure to bring it in the front way—in fact, the bees will not be bothered with people in front of the shop; they want no publicity, and we must humour them if we want honey.

"At the risk of appearing tedious we repeat that these two preliminary conditions are of great importance. But it must be remembered that bees care nothing about scenery or indeed propriety. They will sail across a wood-yard or a melancholy marsh with as much gladness as over a flower garden, or through a labyrinth of costly statuary, provided they can find their way to suitable pasture. When in full work, they generally rise up high into the air immediately after quitting the hive, and no one can say where they are going to; but in coming home laden, they sail low, and cannot abide interruption in regaining the hive. Therefore we may plant our bees in any clean dry place, whence they can go out freely in any aspect from due east to due south—midway between these points being best, and where also we can find room in the rear for necessary manipulations. An arched recess in the wall of the house forms a capital

site for an apiary, if fulfilling the primary conditions. The best apiary we know of is in a stable, which, being no longer required for its ostensible purpose, was slightly altered for the bees. One of the walls facing the south-east was pierced with holes at proper distances to suit a row of hives. A shelf was placed against this wall, the hives were put in their places, and the bees went on with their work happily, and it was a rare occurrence to find a bee in the house itself —they were too particular to keep to their own porches and halls. The windows on the north-east side afforded abundant light for the bee-keeper's operations; the stall occupied only a width of three feet at most on the wall appropriated to it, and the other part of the place was used as a tool-house, and a store for roots. 'The best apiary!' yes, not for any outward elegances, but for the glorious work that was done, for the owner knew how to handle bees, the country was rich in bee pasture, and great honey harvests were sent from it, and were eagerly purchased at the rate of half-a-crown per pound. 'Thou shalt not put thy trust in horses,' said the bee-master one day as he lifted a box of honey weighing twenty-five pounds, and said that it was one of the purest samples his little workers had ever given him.

"Next as to the apiary itself. Bees thrive better sheltered than exposed, but a free circulation of air about the hives is of great importance. In desperately hot weather, the combs will melt and fall within the hives if they become over-heated, and a free ventilation is a grand cooling agent, provided at the

same time that the direct rays of the sun are screened off. To make this part of the subject plain, let it be understood that any kind of shelter will do, for the bees care not one straw what it is if they are but dry, and can breathe the free air of heaven. But a caution here. A low thatched roof standing just above the hives, will in summer time be always full of spiders, and to dislodge these vagabonds is simply impossible. Before we took up our residence in Stoke Newington we had a pretty low-roofed thatched cottage for our bees, and the spiders were a perpetual nuisance. In hot weather spiders may swarm about the house and do no harm, for the bees pass through their horrible meshes unhurt; but when the foggy mornings and chilly damps of autumn come, the poor dears are trapped wholesale, they stick fast in the wet webs, and the bees being then weak and the spiders strong, the first fulfil the undesirable purpose of making the second fat. To see a bee fight with a spider, and the spider invariably get the best of it, is a pretty study for the apiarian, but the less of it the better. Our bee-shed consists of a hipped roof of timber supported on stout uprights of larch with the bark on; over the timber is laid felt well pitched and dusted with sand. It is open on all sides, but in winter is roughly boarded in, for our Hermitage is in a miserably bleak spot—Stoke Newington is a fine imitation of the arctic regions, considering we are only five miles north from the General Post Office. Measurements are useful. The width of our roof is twelve feet, and the height from the ground eight feet, affording ample shelter from driving rains and also

ample head-room for lifting, which is a matter of no small importance. It matters not what the length of the house is, but where space is a matter of consideration, a semicircular or half-octagonal form, as represented at page 152, may be adopted. In such a case one side will face due east, and the other side due south. Perhaps a point or two beyond these extremes may be allowable, but we cannot say from experience how far north and west aspects are allowable."

When once fixed, do not move your bees, for the mischief of this act is self-evident. I cannot enforce this recommendation better than Gelieu has done. "I have seen people," says he, "shift about their hives very inconsiderately; but change of place invariably weakens them, as the bees will return to their old residence, the environs of which are so familiar to them. A hive should remain as fixed to the spot as the ancient oaks, in the hollows of which the insects delight to establish themselves; where they have their young, their companions, their queen, and all their treasures. When the young bees take wing for the first time, they do it with great precaution, turning round and round, and fluttering about the entrance, to examine the hive well before taking flight. They do the same in returning, so that they may be easily distinguished, conducting themselves nearly after the same manner as the workers of a newly-hived swarm. When they have made a few excursions, they set off without examining the locality; and returning in full flight will know their own hive in the midst of a hundred others. But if

you change its place you perplex them, much the same as you would be perplexed if, during a short absence, some one lifted your house and placed it a mile off. The poor bees return loaded, and, seeking in vain for their habitation, either fall down and perish with fatigue, or throw themselves into neighbouring hives. When hives are transported to a long distance, there is no fear that the bees will return. But this inconvenience would be sure to take place if they were removed only a few hundred paces from the spot to which they have been accustomed. The hive may not perish, but it will be greatly weakened. In my opinion, if the situation is to be changed at all, they should be taken at least a mile and a half." This removal should only be attempted in winter or early spring, under usual circumstances. It might, however, happen that it was required to move a hive only a very short distance, in the summer time; when no harm would arise were the change of location made by daily shifting it a few inches. Mr. Hibberd remarks on the loss that must inevitably ensue from this cause, if an established stock (not a new swarm) is purchased of a near neighbour, in which case a great number of the bees are certain to return to their old home. He further gives the useful piece of information, that, after removing his own apiary a distance of two miles, he went to the old spot on the following day and saw just a few bees buzzing about it; but on the day after there was not a single one. Hence it would appear that the distance of a mile and a half is sufficient as far as appreciable losses are concerned; but, to be absolutely secure against return of the bees,

there is nothing less to be done than to move them to double the utmost range of their old flight.

BEE PASTURAGE, AND NUMBER OF HIVES.

It is almost needless to say that on the nature and extent of the vegetable productions, following in succession, in the immediate neighbourhood of an apiary, must mainly depend its prosperity. After every care has been taken on all points of housing and management, it is in vain to expect a large harvest of honey where nature has limited the sources of supply or restricted them to one particular season of the year. The most highly cultivated corn districts are rarely so favourable to bees as those in which wild commons, woods, and heathy moors prevail; or where some such farm products as Dutch clover, trefoil, saintfoin, buckwheat, tares, mustard, colewort, turnip or cabbage blossoms, do not enter largely into the staple of the country. The neighbourhood of some kinds of willows, too, and of hazels, in the opening spring, is of great advantage to our little collectors in furnishing farina; as also the blossoms of the furze, broom, bramble, wild thyme, borage, the golden rod, &c. To these we may add the large early stores of honey and farina available from many of the products of our horticultural gardens and orchards, as gooseberries, currants, raspberries, apples,* pears, plums, and other fruits. Wallflowers and mignonette are

* Dr. Dzierzon and some other German bee-masters are, however, suspicious of apple blossoms as apt to occasion foul-brood, as well as a complaint which they term the "mad sickness." They couple in this connection "apple and mountain ash."

also capital stores of honey, and so are lime trees. Payne says, "I have always found the advantage of planting in the vicinity of my hives a large quantity of the common kinds of crocus, single blue hepatica, *Helleborus niger*, and *Tussilago Petasites*, all of which flower early, and are rich in honey and farina. *Salvia nemorosa* (of Sir James Smith), which flowers very early in June, and lasts all the summer, is in an extraordinary manner sought after by the bees; and, when room is not an object, twenty or thirty square yards of it may be grown with advantage. *Origanum humile*, and *Origanum rubescens* (of Haworth), and mignonette may also be grown. *Cuscuta sinensis* is a great favourite with them; and the pretty little plant *Anacampseros populifolium*, when in flower, is literally covered by them. Garden cultivation, beyond this, exclusively for bees, I believe answers very little purpose."

It will follow as a matter of course from what we have said, that the size of an apiary in any district must be mainly determined by circumstances. In some seasons, so prolific a harvest of blossoms and honey comes all at once, that a large number of hives may abundantly be filled together. The locality must be the chief guide; and I have known instances where fewer stocks would have yielded a much better return, for one rich colony is worth more than two or three half-starved ones.

The distance to which bees will resort during the honey harvest has been the subject of some interesting observations. Mr. Hibberd writes, "The adventurous person who kept bees for many years in

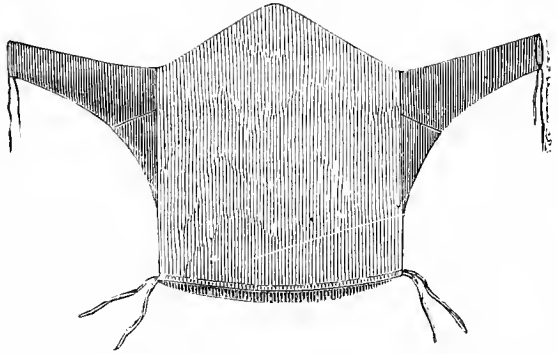
the garret of a house in Holborn,* performed an experiment to ascertain how far, and to what pasturage, his bees travelled. As they came out of the hive in the morning he sprinkled them all with a red powder, and immediately set off to Hampstead, thinking it most likely he should meet them there. What was his delight at beholding, among the multitudes of humming workers, some of 'his own little fellows, which he had *incarnadined* in the morning.' From Holborn to Hampstead Heath is about four miles." He refers also to Mr. Huish having observed bees on an island in the Frith of Forth, containing no hive, and distant four miles from the mainland. Such extended ranges may, however, be set down as both exceptional and prejudicial; and Mr. Taylor is doubtless right in believing, with Dr. Dunbar, that the *ordinary* range of their excursions is comprised within the radius of a comparatively small circle. When pressed for stores they may be impelled to these wider flights, directed, probably, by their very acute sense of smell.

BEE-PROTECTOR.

In operating with bees it is important to make as little bustle and disturbance as possible, and have at hand an assistant and whatever is likely to be wanted, for a very trifling matter will often mar an operation irretrievably. Let all things be done coolly and quietly, and without hurried motions of any kind,

* This was the celebrated Daniel Wildman, chiefly known by the extraordinary control that he obtained over his bees, and the performances which he trained them to go through.

which cause suspicion and irritation: in short, the aim should be to do what is needed without the bees being conscious of it.



Security from attack, however, is essential to self-possession, and I know of no covering so effectual as an envelope I devised of a kind of light net or gauze, sometimes called *leno*. It should be so made at the top as to go over a hat or cap; with sleeves, tied at the wrists, and strings, or an elastic band, to fasten round the waist. The sleeves may be made of some stronger material (see preceding figure). The entire upper part of the person is in this way enveloped, as seen in our engraving annexed. The projection of the hat keeps the dress clear of the face, and it is sufficiently transparent. A pair of india-rubber gloves is all that is further necessary to complete protection. Some wear these outside of woollen ones; it is said, however,

that the smell of the wool will incite to stinging, and so will that of some kinds of leather.

Remedy for the sting of a bee.—Various remedies and directions have been from time to time prescribed. In the first place, the sting should at once be removed, but without rubbing the part. My own experience leads me to recommend, in preference to anything else, the immediate application of *liquor potassæ* to the spot, as a powerful alkali, to neutralise the poison of the sting, which is an acid. It should be used in small quantity, on a point of some kind, as a needle, introduced into the wound. In the absence of this, *pure liquid ammonia* is said on good authority to succeed, if properly applied. Keep it in a close-stopped, small-necked bottle, which should be turned bottom-upwards, and held very tight over the part. Some persons have found relief from an immediate application of cold water. Indeed, any remedy to be efficacious must be speedily resorted to; and particularly in the warm months, for then the poison is much more active than in winter.

A variety of other recipes are prescribed by different authors. It is strongly advisable, immediately after removing the sting, to press the hollow of a key over and around the point of incision. To wet the part freely with saliva is one recommendation; another is to do the same with tobacco-water; and even the blue-bag, resorted to by cottagers, has a beneficial alkaline power, though it may be the soda in which it has been steeped which imparts a large portion of its efficacy. A medicament specially prepared for the purpose is sold by the name of "Dr. Pine's Bee-keepers' Lotion;" and

another is made from the marsh stone-crop, or *Sedum palustre*.

Precautions.—If attacked by a bee, the best plan is not to offer resistance, but to walk away and thrust your head into a neighbouring shrub or bush, when the enemy will in all probability retire. In addition to the hints given at the commencement of this section, there are some peculiarities in the ways and moods of bees, against which it is well to be on one's guard. Without asserting that they are actually fond of particular persons, we know that their strong discrimination of scent renders others the objects of their very marked dislike. They appear to be offended by any strong smell which is not that of sugar or of wax; hence, whether it be a sweaty horse or a highly perfumed dandy, they are equally wont to declare war against him. There are also particular periods and occasions when they are vastly more irascible than at others. The loss of their stores in autumn is likely to make them deeply resentful; hot weather or electricity puts them out of sorts, and so does being kept at home by rain. They, again, are naturally more excitable if interfered with at night or at any unseasonable hour, or when some previous cause of distraction has arisen, as the discovery that they are queenless, and this even during the half-hour or so that her majesty is absent on her wedding flights. The importance of calmness and confidence has already been noted, and it is said that the bees are far more likely to attack a person who watches at a supposed safe distance, or who fidgets about, or covers his face with his hands, than one who advances boldly into

closer proximity. Though a pair of bellows is effectual in quieting them, they must never be blown with the mouth, for the human breath is to them an abomination. Again, the hand should not be waved near them, nor even pointed at them. It is further advised not to approach them with the head uncovered, lest a bee might settle, or be blown against the hair, and there become entangled. When one of them has stung, the others know of the fact by the smell, and are incited thereby to go and do likewise; while, if one of them is crushed, there will be a whole troop of speedy avengers aroused. The safest time for performing operations in the hive is during a pleasant day at an hour when most of the older bees are abroad. Stinging ensues when the hive is supposed to be endangered, and it is only under actual provocation, or circumstances wholly exceptional, that it is to be feared from a bee upon the wing.

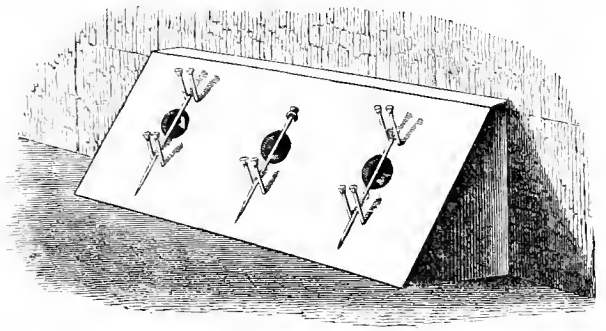
MISCELLANEOUS APPARATUS.

We have had occasion to make an incidental allusion to several fittings and appliances besides the two or three which have formed the subjects of separate sections. But, in addition to these, there are a host of articles of more or less necessity or convenience, a full description of which would very materially enlarge our work, especially if we were to take into account the many rival contrivances of different makers. All that it therefore seems desirable to do is to append a list, with the briefest possible descriptive remarks, of those species of apparatus which

are frequently of service, or the names of which are most likely to be met with. Those that have been already described, or that will be so in the second part of this book, may be found, when required, by consultation of the Index.

Payne's Glass.—A bell-glass with a three-inch hole in the centre, designed to stand under another bell-glass.

Bee Traps.—Devices of various kinds for placing over supers upon their removal, with the object of letting out the imprisoned bees, but preventing their return. The figure shows the "Cheshire Pin Trap."



Drone Preventers.—Another name for queen-preventers, already described (pp. 66, 93).

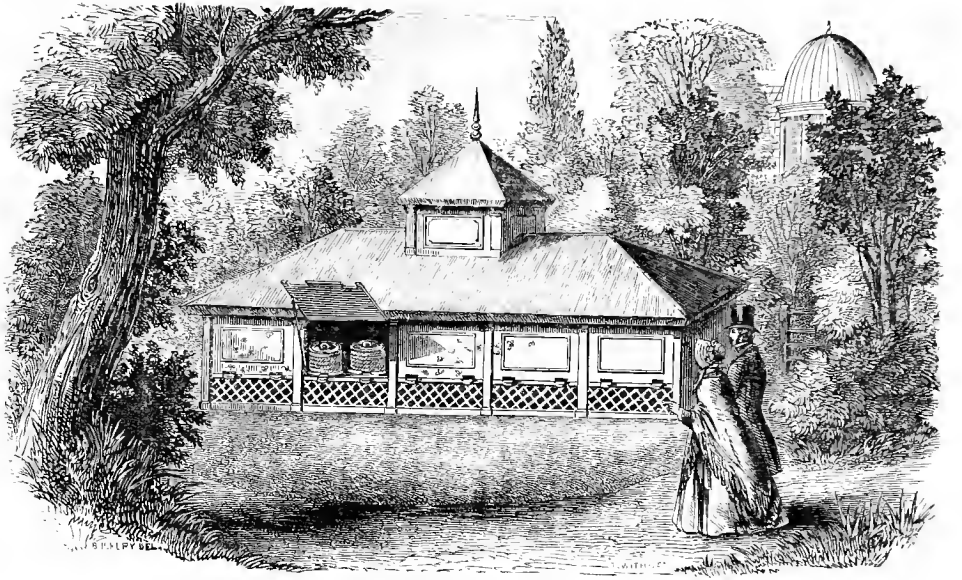
Drone Traps.—Boxes to affix to the mouth of hives through which (the entrance thereto from the hive being light, but the flight-hole darkened) all the bees seek to make their exit; but from which none can reach the open air except through drone-preventing perforations. The object is to detain and destroy

the drones when these are too numerous; but such traps obstruct ventilation, and their use should at the least be restricted to about an hour in a day, at the time when drones are chiefly issuing forth. The return to the hive is made by the regular flight-hole, where an interposed ridge just permits of entrance.

Cheshire's Swarming Board.—A flat piece of boarding, some three feet square, to be placed on the hive-stand for the purpose of transferring a swarm from a hiving-skep to the permanent hive. The floor-board is removed, the swarming-board taking its place, so as to project by half its surface in front of the stand; the hive is then propped up upon the part resting upon this, when the swarm can be gently emptied on to the projecting half.

Cheshire's Guide Maker.—A cast, in plaster of Paris, for producing embossed wax guides, or comb foundations (p. 88), beneath the bars of frames.

Honey Cutters.—Knives shaped and turned in different ways for convenience in cutting out the combs from hives.



SUMMER MANAGEMENT.*

The question has often been put to me, "How and at what time can an apiary be best commenced?" Some remarks in reference to this subject will be found under the heads both of "Autumn" and "Spring Management." At present the reader is supposed to have been put in possession of a prime swarm, and the earlier in the season this is done the better.† Mr. Golding thus advises on the best method of *conveying bees:* "When these are brought from a distance, it should be on the day in which they are hived, and in a cloth of coarse texture, which should be tied round near the bottom of the hive, so as to prevent the escape of the bees. Tie up the cloth by its corners over the top of the hive; and, if carried by the hand, or properly suspended, a swarm may be removed in this manner for miles." But if the journey is to last for three hours or more, it will be important to ensure top ventilation. An ordinary skep will thus require to be *inverted*, and this operation must be most cautiously performed, turning the hive in the direction in which

* "Spring" is in this volume placed after "Winter," for the reason explained on the next page.

† All careful bee proprietors will take the precaution to record the weight of the empty hive, and of its floor-board, before stocking it; a matter of subsequent importance in ascertaining the contents. A journal, also, recording dates, and the various operations of the hive, as they arise, will be useful in many ways.

the combs run—in which direction all hives must be held during conveyance. With frame hives it is recommended to take two laths, not thick enough to cause an aperture that will permit the escape of a bee, and nail them across the tops of the frames (which must be fastened securely in position), and then to screw down the crown-board, or, still better, a sheet of perforated zinc, above these laths. For periods of prolonged confinement, as in the case of removals by rail, a material like canvas would be insecure, as the bees would eat it completely through.

All experienced apiculturists know that no colony of bees thrives, or works so well, as one that is populous at the outset. Should any doubt exist on this point, it is often expedient to unite a second smaller swarm to the first, but this must only be attempted within a few days, before many combs are made, or mischief would result. Our recommendation applies with greater force in a late season, or to the case of second swarms, which are rarely strong enough, separately, to collect sufficient winter stores. Of the mode of proceeding in effecting these junctions we shall hereafter speak, when treating of "Uniting Swarms," under the section "Spring Management."

The plan originally designed in the BEE-KEEPER'S MANUAL supposes, as has before been intimated, an arrangement embracing directions for the management of an apiary "according to the order of the seasons." Our legitimate commencement, therefore, must practically date from the separate existence of the recently established colony; noticing,

as we proceed, the various substances stored or used in a hive, and collected more or less abundantly, according to circumstances and season.

Should the weather now be fine, operations are commenced with astonishing activity, the bees being at first solely intent on preparing their new dwelling for its intended objects—the rearing of young, and storing supplies for the future requirements of the family. If, however, circumstances are such as to prevent them from quitting the hive for several successive days following swarming, and before provision is accumulated, recourse to feeding becomes expedient, or starvation might ensue. Under *any* circumstances, some apiculturists have advised giving a syrup of sugar to a newly-hived colony; such syrup to be prepared as explained under "Spring Feeding" (page 276)—not the one specified in an earlier position under "Autumn," which is not sufficiently liquid for the insects in seasons of full flight. It is well known that, on leaving the parent stock, the bees carry with them a good deal of honey. There is little doubt that the main object in this provident proceeding is to enable them at once to commence the work of building: this they do almost as soon as they are hived, a piece of comb being frequently made on the same day, which is as quickly appropriated, either as a receptacle of honey or of eggs, if the queen is already fertile. Where a young queen has accompanied the swarm, such is not always the case, and this occasions a delay in laying of several days.

The entrance of the hive should now (and at all

times when the bees are at full work) be opened to its whole extent.*

Wax and Combs.—The material of which the combs are so curiously formed is wax, *secreted by the bees themselves*, and not any substance directly conveyed into the hive, as is sometimes erroneously supposed. Its component parts are carbon, oxygen, and hydrogen. To enable them to form this secretion, the workers must have access to honey or some other saccharine matter; and this is the first thing sought by a new colony. The quantity

* To the spectator the view of a recent swarm is animated in the extreme, and probably suggested the

SONG OF THE BEES.

We watch for the light of the morn to break,
And colour the eastern sky
With its blended hues of saffron and lake;
Then say to each other, "Awake, awake!
For our winter's honey is all to make,
And our bread for a long supply."

Then off we hie to the hill and the dell,
To the field, the wildwood, and bower;
In the columbine's horn we love to dwell,
To dip in the lily, with snow-white bell,
To search the balm in its odorous cell,
The thyme and the rosemary flower.

We seek for the bloom of the eglantine,
The lime, pointed thistle, and brier;
And follow the course of the wandering vine,
Whether it trail on the earth supine,
Or round the aspiring tree-top twine,
And reach for a stage still higher.

As each for the good of the whole is bent,
And stores up its treasure for all,
We hope for an evening with hearts content,
For the winter of life without lament
That summer is gone, with its hours misspent,
And that harvest is past recall!

required is very great, it being estimated that thirteen to twenty pounds are necessary to make one pound of wax; hence, if the combs of a hive weigh two pounds and a half, there will be some forty pounds of honey consumed in their production—a fact illustrating the great temporary loss incidental to the issue of swarms. The popular opinion is, that the substance often seen adhering so abundantly to the legs of bees is wax, and that as such it is the basis of the combs. But at the time when comb-building is proceeding more rapidly than at any other period, the bees are loaded with but little of this substance; while in the early spring, when few or no combs are constructed, they carry it into the hive with the utmost avidity. "To see the wax-pockets in the hive-bee," observe Kirby and Spence, "you must press the abdomen, so as to cause its distention; you will then find on each of the four intermediate ventral segments, separated by the carina or elevated central part, two trapeziform whitish pockets, of a soft membranaceous texture; on these the laminæ of wax are formed, in different states, more or less perceptible." "Whenever combs are wanted," says Dr. Bevan, "bees fill their crops with honey, and, retaining it in them, hang together in a cluster from the top of the hive, and remain apparently in a state of profound inactivity about twenty-four hours. During this time, the wax is secreted, and may be seen in laminæ, under the abdominal scales, whence it is removed by the hind legs of the bee, and transferred to the fore legs; from them it is taken by the jaws, and after being

masticated, the fabrication of comb commences." An extraordinary degree of heat always accompanies comb-building, supplied no doubt by the large quantity of oxygen at that time generated. The rapidity with which comb-building proceeds is something astonishing. Von Berlepsch tells us of the construction of four hundred square inches in a single night; while several other observers have cited instances almost on a level with this.

The form and number of the combs in a hive vary considerably, the bees adapting them according to the shape of their domicile, so as to fit and fill in every part, and often very irregularly. At first they are beautifully white, but soon, from the heat of the hive, they become tinged, and finally turn nearly black. The worker-breeding cells are made the first: they are invariably hexagonal in form, and of one uniform size and depth; but those intended only for the storing of honey are often somewhat larger and elongated, sometimes more so on one side than the other. A small dip or inclination upwards is given to the cells, the better to prevent the honey from running out, assisted, moreover, by a small bar or thickened border of wax, at the entrances. The cells in which the drones are bred are larger in diameter than the common ones, and they are generally placed nearer the outside of the hive, though occasionally joined on to the others. When this takes place, our little architects have the sagacity to interpose two or three rows of cells of an intermediate size, gradually enlarged to the proper dimensions; these, being of irregular figure,

are appropriated to the holding of honey or pollen. In this, as in everything else, the bees adapt their operations to circumstances; thus they construct their combs either by suspending them from the top of their dwelling, or occasionally by working them from the bottom upwards.

The following details from Mr. Shirley Hibberd's "Rustic Adornments" may be acceptable to some of our readers:—

"The combs, or clusters of cells, are arranged in vertical and parallel plates, with a space of about half an inch betwixt contiguous pairs; and each comb is nearly an inch in thickness. At the outset, when one wax-making bee leaves the suspended cluster alluded to, and lays the foundation of a cell, others follow in rapid succession, not only adding their wax to that of the first, but soon commencing new combs, one on each side; and so the work goes on, in most cases until the whole roof is covered with foundations. The architects proper, also, are meanwhile at their finishing work. 'They have,' says Réaumur, 'to solve this difficult geometrical problem: a quantity of wax being given, to form of it similar and equal cells of a determinate capacity, but of the largest size in proportion to the matter employed, and disposed in such a manner as to occupy the least possible space in the hive. Wonderful to reflect upon, this problem is solved by bees in all its conditions, in their construction of hexagonal or *six-sided* cells. The square and the equilateral triangle are the only other two figures of cells which could make them

all equal and similar without interstices. But cells of these figures would have either consumed more material, or have been weaker; and they would also have consumed more space, being less adapted to the form of the bee. In short, the hexagonal form combines all the requisites of economy and capacity. Another wonderful arrangement is seen in the construction of the bottoms of the cells. Each of these is composed of three rhombs, or plates of wax in the shape of card-diamonds, disposed in such a manner as to form a hollow pyramid, the apex of which forms the angles of the bases of three cells on the opposite side, giving to each of them one of the three diamond-shaped plates required to form their bases. The three rhombs, composing each cell-bottom, have the two obtuse angles each of 110 degrees, and, consequently, each of the two acute angles of 70 degrees.' So far Réaumur.

"The cells of the bee are extremely delicate, two or three plates or sides being of the consistence only of a common leaf of paper. They are made strong, however, by mutual support and other means, besides a sort of froth which the insect mixes with the wax. The cells, at first of a dull white, soon appear yellow on the interior, the change arising from the plastering over them of a compound varnish of wax and propolis. Each cell is soldered, too, at its mouth, by a similar compound of a reddish colour, having in it more propolis; and threads of the same substance are laid around the walls, to bind and strengthen them.

"It is now to be observed that all cells are not

alike. They have four different uses in the economy of the hive, and are constructed variously to suit these. One set of cells is for holding the eggs or embryos of worker-bees; a second for those of males or drones; a third for those of young queens, hence called royal cells; and a fourth set are for the reception of honey and pollen. The first are generally about five lines in depth (or less than half an inch), and two lines and two-fifths in diameter. The cells of the young males are much less numerous, and measure from six to seven lines in depth, by three and a half in diameter.* It is worthy of note, that in passing from the construction of worker-cells to those of drones, in the same comb, the architects do not alter the size at once, but gradually; thus disordering in the slightest possible degree the delicate arrangement of the bases of the cells. In shifting from larger to smaller, the same rule is observed. After the chief breeding season is over (to some extent young bees are produced at every season of the year), the cells, both of worker and male bees, are used for holding honey. Those made purposely for that end are chiefly marked by a greater divergence from the horizontal plane, that the honey may be better secured; and it is curious to observe that, in a very warm season, these wise insects give the floor a still greater dip from the mouth inwards. As the store enlarges, they seal up the mouth with a ring of wax, to which they gradually add concentric layers

* It may be added that those for drones stand nineteen to the square inch, and those for workers twenty-seven.

till the cell is filled, when they close it altogether—reserving its treasure for use during winter and spring. Pollen, as brood food, is kept in cells of considerable size."

Propolis.—To attach the combs firmly in their place, the bees employ a pliable greyish substance of balsamic odour, called *propolis*, which is a glutinous exudation from certain trees, or their buds, and which they collect immediately on swarming, blending with it a portion of wax. With this material they varnish the lids of the closed honey-cells, glue up all crevices in the hive, and cement it down to the floor. Among the trees which are the sources of propolis, the fir, willow, poplar, birch, and alder are noted; but almost any resinous substance can be utilised by the insects to its supply. It is kept, says Von Berlepsch, in five-sided outer cells.

Honey.—We have seen that the first want of the swarm is honey. This the bees collect, by means of their probosces, from the nectaries of certain flowers, from whence it derives a greater or less variation in flavour, aroma, and actual composition; while, as to colour, it ranges from nearly transparent to various shades of brown. The bees receive it into their first stomach or honey-bag, the greater portion being subsequently regurgitated into the cells, for which purpose those of both workers and drones are employed, in addition to the irregular cells which are incapable of serving any other purpose. The honey-cells, when closed, are distinguishable from those containing brood by being whiter in appearance, and often slightly concave. The brood-cells are more

coloured, besides being a little convex. In some seasons honey is abundantly collected when in the state of what is termed *honey-dew*, a viscous substance found adhering to the leaves of particular trees, especially the oak.* This occurs largely in certain years, whilst in others it is found very sparingly or not at all.

In former editions the following was inserted as a note at the end of the section on "Spring Feeding:" "I am not amongst the number of those who (to my apprehension) go out of their way to maintain that this vegetable secretion undergoes some kind of chemical change by passing into the stomach of the bees (in reality a mere receiving bag), from whence it is often regurgitated into the cells of the combs in a few minutes, or even seconds, of time. Honey doubtless derives both its colour and flavour immediately from the plants supplying it; the bees not possessing the power of altering either. It even sometimes contains an original poisonous matter. Its subsequent thickened consistency naturally results from the effect of a lowered temperature; acting in a greater or less degree, according to circumstances, season, &c. That the bees have not the ability to change chemically the contents received into their honey-bags, is shown by an examination of the saccharine mixtures given to them as artificial food; in which I never could detect any alteration after being stored in the

* There are two species of honey-dew, the one a genuine exudation from the leaf, the other the deposition of one of the aphis tribe. The bees resort to both kinds; but the latter deteriorates the honey sadly for human use. Honey from the *pine* ruins the bees themselves.

combs." We may add that the majority of authorities long coincided with our author in this view; but the question still remained one of the nicest problems in the science, whilst the great name of Dzierzon was numbered among the upholders of a chemical change. Quite recently, however, as Mr. Cheshire has kindly informed us, it has been established that a certain acid, as yet undefined, is communicated to the nectar by the bee. In all other respects it would appear that the constituents remain exactly as they were, and thus we may say that an intermediate result has been arrived at.

Pollen, or Farina.—The hive will be rapidly filled with combs, and progressively with an increased population, for the eggs, as we have seen in page 15, are matured in three weeks. In the meantime, the bees will have commenced a new labour—that of collecting pollen or farina. This is the anther-dust of the stamina of flowers, varying in colour according to the source from whence it is derived; and it may be remarked that the bees in their collection never mix together the pollen of different plants, but in each excursion visit only one species of flower.* By a peculiar adaptation, they are enabled to brush this off, and pack it into the spoon-like cavities (or baskets as they have been termed), furnished for this object, on the centre

* This is not the case when it is honey that they are seeking, but with the pollen there is, we believe, only a single instance recorded in which the two "stockings" of a bee have been observed to differ in colour. The fertilisation of the plants themselves (see pp 18, 19) would be sadly disarranged were it not for this law being observed by the bees.

joint of their hind legs, where, as was above pointed out, it is often mistaken for wax. The powder or meal thus conveyed into the hive is by other bees afterwards kneaded up into paste, and stored for use in the worker cells, adjoining those containing brood. To preserve it from the air, a small portion of honey is put on the top of each cell, coated over with wax. Thus prepared, it is a very heavy substance; and this often leads to a false estimate of the value of a hive, for the annual collection of pollen has been variously estimated at thirty to one hundred pounds in a single family.

Naturalists are pretty well agreed that the store of pollen or farina is used (with a mixture of honey and water) chiefly for feeding the larvæ; though a portion of such compound may form, occasionally, the sustenance of the bees themselves. It appears established, indeed, that without partaking of pollen they are unable to transform the honey they have eaten into wax. Mr. Cheshire speaks of pollen as constituting the flesh-forming nutriment, and honey as the heat-forming; and this view, of course, corresponds with the fact of the former being needed chiefly by the growing grubs, next by the queen (see page 13) to repair the waste of laying, and least of all by the full-grown workers, and that chiefly at a time when they are about to undergo a temporary loss of substance (though we are told by Von Berlepsch that they also resort to it daily—as a sort of tonic, we may suppose—for some time after the close of the working season). It is stated, however, that the nurse-bees supply digested pollen to the drones as

well as to the queen, in which case, as far as we can see, the design must have reference to stimulation towards the only known function of the drones' existence.

Water.—At certain dry periods, but always in the breeding time, bees require a supply of water, which is necessary in preparing the farina and honey for the brood, as well as to enable them to secrete wax. If no pond or brook is within a reasonable distance, a shallow vessel should be filled frequently to the brim, with a piece of thin perforated wood floating on it and covering the whole surface; or it may be filled with moss or pebbles, pouring in water to the top, and placing it near the apiary. Precaution is necessary, for the bees easily slip into the water and are drowned. The partaking of pollen and of water by the bees are occurrences which go very much together, and which each of them, at certain seasons, involve their own special precautions; but in summer time the bee-keeper is obviously set free from any concern in regard to the supply of pollen.

Shade.—It has already been observed that out-door hives ought not to be left exposed to the mid-day and afternoon sun in sultry weather; the heat not only rendering the bees extremely irascible, but subjecting the combs to melting, and with most disastrous consequences. In all such cases it is well, therefore, to give the comfort of a mat, or something of the kind, thrown over them. In the words of Gelieu, "They delight best in thick forests, because they there find a uniform temperature and a propitious shade. It is a mistake to suppose that bees exposed to the sun produce the earliest and strong-

est swarms: I have often experienced the reverse. Bees like the shade when working [at home], and the sun only when in the fields."

Moths, Wasps, Hornets, and other Enemies.—In the warm summer evenings, bees are often much annoyed by the attempted inroads of moths, particularly the small wax moth (*Tinea mellonella*), of a whitish-grey colour. These are sometimes formidable foes, and their appearance at dusk on the alighting-board is the signal for a commotion. It is difficult to eject them if they obtain a footing in a hive, where they will deposit their eggs, spinning their silken webs, and now and then increasing so as even to cause the entire destruction of the colony. When these vermin have established themselves, there is no remedy but driving the bees into another hive. To prevent the ingress of these troublesome invaders, it is sometimes desirable for an hour or two in an evening to close the entrance, by placing before it a screen of gauze, wire-grating, or perforated zinc, to be removed at dark.*

Poultry, and some other kinds of birds, will feed upon bees; and many, that from weakness or other causes fall to the ground, become a sacrifice to them. In particular, that little marauder, the blue tomtit or titmouse (*Parus major* of Linnæus), must not be tolerated. In summer he will devour bees, and feed his young with them; and in winter he

* A difficulty sometimes occurs when it is necessary to confine bees, or drive them into the hive, as the alighting-board is often covered with them in an evening, and the numbers are increased on the least alarm. In this case take a small watering-pot, and gently sprinkle the board and entrance, when the bees, mistaking it for rain, will retire within.

will even try to force an entrance into the hive.* Rats and mice must also be guarded against, as well as slugs and snails. The toad, too will occasionally make his home beneath the hive-stand for the purpose of capturing such bees as fall.

The nests of wasps ought to be destroyed: from their superiority in strength and activity, they are very annoying, and often destructive, to bees towards the end of summer; and the nuisance must forthwith be met by contracting the entrance to the hive, when the passage is more readily defended.† In this place it may be well to draw attention to a very simple mode of dealing with wasps attacking a

* In some parts these birds are very numerous; and poison has been found efficacious, placed at the hive mouth, in little balls of lard, oatmeal, and nux vomica, mixed together.

† Huber's observations on some of the habits of bees have been the subject of ignorant ridicule from Huish; as where he says that they occasionally erect barricades, for greater security. But Mr. Golding has given a confirmation of Huber's assertion. He says, "At the end of summer, a kind of curtain, apparently a compound of wax and propolis, and about a sixteenth of an inch thick, was erected before the entrance of one of my hives; about two inches and a half in length, and half an inch in height, with the exception of a small aperture at each end." Dr. Bevan, in the "Honey Bee," exhibits a drawing of this piece of fortification. My own experience is perfectly conclusive, as the following extract from my journal will show: "July 31, 1842. Weather fine. Removed a box of honey from a collateral hive. The wasps had been troublesome for some days, and as the entrance to the centre box was left fully open, the bees had contracted it for better defence. A thin wall of what appeared to be propolis was attached from the upper edge of the doorway, extending along its centre, and closing all up but a space of about three-quarters of an inch at each end. I never witnessed a more convincing proof of the sagacity of the bees than this beautiful proceeding." So runs my journal; to which I may add, that the entrance to the box, so contracted, was five inches in length, and three-eighths of an inch high; or double that of Mr. Golding. From the hint thus derived from the bees themselves, I constructed the movable blocks or mouth-pieces described and shown at page 75.

hive. We shall have occasion hereafter to notice the fondness of bees for barley-sugar: let a piece of this be laid across, or just within, the entrance of the hive, so as greatly to narrow it. This is so attractive to the bees, that they muster at the door in greater force than the wasps durst venture to assail. As fast as the fortification is devoured, it ought to be renewed, and the out-generalled enemy will retire from a hopeless contest.

Insects of all kinds, as earwigs, spiders, wood-lice, &c., should be cleared away from the hives and stands, and ants' nests destroyed. Cobwebs must not be permitted to remain, or numerous deaths would ensue to the bees from entanglement in them. In short, we may sum up by a general recommendation of cleanliness in every way, and the removal of whatever serves as a harbour to dirt and vermin.

Super-hiving.—Should the weather continue favourable for honey-gathering, the colony must be inspected in about three weeks from the time of hiving. Indeed in sultry weather, and where the swarm is a large one, it is often politic to place a glass or small super upon it very soon, for the purpose of a ventilator, to moderate the temperature, and prevent the clustering of the bees at the mouth of the hive. If the combs are worked pretty nearly down to the floor, and the cells in a good measure filled, no time should be lost in supplying additional working room; more especially if symptoms of crowding are apparent, for by this time young bees are coming forth. We may here observe that many

experienced bee-keepers object to supering in the case of a new colony, preferring to give the requisite room at the bottom, by means of a *nadir;* which often ensures abundance in the stock-hive—itself being removed in the autumn. Under the head "Swarming and Depriving Systems," are some remarks as to the mode of using nadirs; as also under those of "Nadir Hive," and "Nadiring Stocks."

As fast as the supers are filled, they should successively be removed, as directed under "Autumn Management." Indeed, after the main honey season is over, which is usually as soon as the dry July weather sets in, it is useless, in most localities, to give any further extension of working room; and, indeed, from the end of this month there is, under common circumstances, often rather a diminution than an increase of store. The supers will, in such cases, be wholly removed, and, if the weather is unfavourable, it may even be necessary to supply food.

In proportion to the wealth of the colony is the determination of the bees to defend it; and their irascibility and vigilance are now greater than heretofore, the strongest stocks showing it the most. The work of the year being pretty well over, all their attention is turned towards home. They become more and more suspicious, and the less they are approached or annoyed the better; for they are slow to forget or forgive an injury.

Bell-glasses.—As these are often formed, nothing can be more objectionable: inconveniently high and narrow, a few misshapen combs are all that can be

packed into the space; and these are afterwards only to be extracted by a general mash. The same remark applies to all supers, of any material, where breadth of surface enough is not afforded for a large number of bees to cluster and labour at one time. Can it be a matter of wonder that a chimney-formed vessel should be twice as long in being filled (supposing that the bees do not forsake it) as a broad one, in which a genial warmth is concentrated, and where several combs can be in progress simultaneously? A reversal of the usual proportions, both in straw and glass supers, is therefore to be recommended. The latter may

advantageously be from nine to eleven inches across; the depth being about half the diameter: straight at the sides, and flat on the top. A piece or two of guide-comb, slightly melted, and fixed by the edges to the top of the glass, previously made warm, will serve as an attraction; or in a large glass, four or eight pieces, radiating from the centre uniformly, will direct the bees in working with a regular design, producing a pleasing effect. A useful adjunct to a glass is a small circular tube of perforated zinc, having a rim round its upper end, by which it is held suspended within a small hole on the top. It should be long enough to reach nearly down to the level of the floor. To the tube, when a little warmed, a narrow piece of guide-comb will adhere, and act as an attraction to the bees: it will be further useful as a central support to the loaded combs.

Whatever may be said as to the pleasing appearance of glass supers, it is doubtful whether in point of utility and economy they can compete with those of straw, made as directed under the head of "Straw Depriving Hives," and which can readily be packed and sent to a distance, if needed: * or shallow supers, as wide as the stock-hive admits, may be cheaply made out of a wooden hoop, three or four inches deep, on which is fixed a thin top, by two or three small screws. These are readily withdrawn, when the top can be lifted up with the combs suspended.

In the use of glasses it is always well at first to prevent the escape of warmth, especially at night, till the bees are well established in their new work-room; and the admission of light is best avoided. A little ventilation afterwards, in sultry weather, is desirable; and this may be given by slightly wedging up the lower edge of the super. If both a crown-board and adapter are in use, it is easy to insert a slip or two of tin or zinc between the two boards, so as to keep them a little separated, for the passage of air, when it seems necessary. Sometimes it is even advisable to introduce between the stock and the super a very shallow box, as a moderator of the temperature. I have found, by experiment, that at a temperature between 95 and 100 degrees, the combs will soften so much as to be in danger of collapsing.

* This remark, it need hardly be said, has no reference to the comparative merits of bar or frame supers, as balanced against round ones of glass or straw.

Triplets and Ekes.—In good seasons and localities, the first super is sometimes filled in time to admit of the introduction of another (or triplet), observing the rules laid down at pp. 60, 61. But even where the first super is completely filled, it is often politic not to remove it for a few days, as its attraction induces the bees to occupy the triplet. On the other hand, if from any cause a super has been left only partially filled upon one hive, it may be removed (the bees being first ejected), and placed upon some other for completion. Instead of a separate triplet, an addition may, in some cases, be made to the first super, especially if of straw, by placing beneath it an eke, consisting merely of two or three bands of the same material; in fact, a hoop. This will save the bees the labour of laying the foundations of fresh combs, as they have but to continue the old ones downwards. We may here call attention to what was said at pp. 96, 97, respecting the use of box No. 3 of the frame hive, and to the various remarks on nadiring.

Removing Crown-board and Frames.—This operation should be performed only when it is warm enough for the bees to fly (if needful at other times, it should be done just after sunrise, the hive being taken bodily into an out-house). The first care, after removing the fastenings, is to insert a knife all round the edges of the lid, and then to pass a string very slowly underneath its whole surface, in order to detach it from the frames, to which the bees are pretty sure to have fastened it down. Then a little smoke should be administered at the flight-hole, and

next the lid may be slightly raised, and a few more puffs blown between it and the frames. The lid is now lifted, and just a little syrup is allowed to fall upon the frames and bees, by means of either a watering-pot, feather, or brush; remembering that in these operations there must be no waving of the hand, nor blowing direct from the mouth.

If there is a dummy-frame, the next process will be to extract this, and then successively to loosen the other frames with a small screw-driver, and shift them a little apart. If there is no dummy, the operator must exercise the greatest care not to give the slightest lateral movement to the first frame he extracts, for the combs will perhaps not be perfectly straight, and the bees upon them may thus be crushed. After this one has been removed, the others may be shifted as above. Either an empty hive, or box, or some other support, must be at hand, and the frames must be deposited upon this in their correct order, so that they may be replaced exactly as they were; to *number* them is a desirable precaution. Each frame must be cautiously extracted, and retained constantly in its perpendicular position; and, when replaced, it must be deposited with the same gradual movement. If there are bars instead of frames, a spatula will be required to detach the combs from the sides of the hive. When all are restored, the front edge of the crown-board is placed upon the back edge of the hive, and it is then very slowly pushed forward into its right position.

AUTUMN MANAGEMENT.

Our apportioning of the seasons is certainly not very scientific, for part of what has been said in the preceding chapter belongs more strictly to the spring, and much of what now follows refers rather to the later periods of the summer. The month of August is usually associated with the collection of harvest. Though this may often hold good as regards honey, yet the storified or doubled stocks of the spring are commonly ready for deprivation at an earlier period, occasionally in May, and so on throughout July; the spring-gathered honey being usually to be preferred in point of quality. I know of no better rule as to the fitness of a super, or of a side hive, for removal, than an observation of the state of the combs and cells, which ought to be completely filled and sealed over, to prevent a loss of honey by running out. In this stage the sooner it is appropriated the better, as a longer continuance only leads to discoloration. As respects a colony of the same year, Dr. Bevan remarks, "As a general rule, no honey should be taken from a colony the first season of its being planted, though there may be an extraordinary season now and then which may justify a departure from this rule:" the produce in such a case is usually denominated *virgin honey*, though that term is often applied indiscriminately to any honey in combs free from brood. But in any event the stock-hive should be first examined, for there is a strong disposition in bees

to carry their stores into a super, though they sometimes afterwards remove them into the stock-hive. In cases where doubt exists as to a sufficiency of winter store, it is often well to allow them to do this; recollecting the further advice of Dr. Bevan, that "it should be an invariable rule never to remove an upper box or hive till an under one is quite full; nor to diminish the weight of a stock-box below seventeen or eighteen pounds, exclusive of the box itself."

To remove a full Box or Super.—The middle of a sunny day may be recommended as the best time to take away for deprivation a box or glass of honey. The mode usually adopted is at once to remove it from its position to a distance from the stock-hive, and there get rid of the bees. I have often found it well to reverse this proceeding. Whether the box to be taken is a collateral or storified one, let the communication from the parent hive be previously cut off, and without any jarring. Entire quietness is the main requisite. Gently lift up the super on one side, inserting under it a small wedge or two, so as just to allow an exit for the bees (the bee-trap of page 169 may here be utilised). It should thus be left for about an hour, during which they will repair the cells that have been severed in the process. A little smoke may then be blown in beneath, or a few puffs from a pair of bellows given above the bars. Those who have used an adapter in addition to a crown-board, or a double adapting-board, will, of course, retain the upper board with the super, disconnecting the two boards instead; a slide, in

such case, may be now passed under each opening of the adapter.

The position of the queen bee must now be a matter of careful attention. If she is not in the super (and she seldom is there after it is filled), the silence that at first prevailed will be exchanged for a murmuring hum, attended by a commotion among the bees; and they shortly after begin to quit the super, without attempting any attack. Should the queen be present, however, a very different scene would ensue, and a hubbub would then commence in the stock-hive; though the loss of their queen is sometimes not discovered by the bees for a considerable time. In such a case, the box must be reinstated in its former position, and the communication reopened till some other day. The bee-keeper who uses queen-preventers need, however, have no fear of her majesty's intrusions. Indeed, she is *seldom* guilty of them even when free access is afforded her; but, if she does enter the super, it is possible that the case may then be further complicated by the presence of brood—which the bees leave very reluctantly, and often not at all. In an emergency of this kind, it is best to restore matters to their previous state, and let the super remain till the brood is perfected. A little patience is sometimes necessary: but all attempts at ejection of the bees by tapping, smoking, or driving would usually, in this case, do more harm than good. So long as they continue to leave the super, it may remain where it is, for on these occasions young bees are sometimes numerous; and if the

super is removed, though only to a short distance, these are in part lost, not having become sufficiently acquainted with the position of their home; or, if they enter a wrong hive, they pay the penalty with their lives. This freedom from disturbance has the further good effect of preventing in a great degree the intrusion of robber bees, readily distinguishable from the others by their hovering about the box, instead of flying from it. These are strangers from various quarters, immediately attracted by the scent attending the removal of a full box or glass. Should a few of these plunderers once obtain a taste or sample of the honey, they speedily convey the good news to their associates, when large reinforcements from every hive in the neighbourhood will be at once on the alert, and quickly leave nothing behind but empty combs.

If all is as desired, the super may now be lifted and removed. When separated, it must not be left or lost sight of, but, if scented out by robbers, be conveyed into some room or out-building to prevent a general battle—which might even extend itself to all the neighbouring hives. The remaining bees may here be brushed out, when they will escape by the window or door. Mr. Golding has sometimes found the advantage of using for this purpose a darkened room, with the exception of a very small aperture, to which the bees will fly and thus make their exit. Others like to remove a super at once to a short distance from the stock-hive, leaving it shut up in perfect darkness for an hour or two. Its edge is then raised up, when the bees will evacuate

it. In the case of a frame or bar super, after most of the bees have left it, it can be placed across a couple of rails or sticks, when the top cover may be unscrewed and detached. It is then readily cleared of bees by brushing them downwards between the bars with a feather or a twig. Single combs can, of course, with these supers, be extracted as they are ready, and empty bars substituted.

The same general directions apply when a full glass is to be removed. If it stands on a double board, a piece of tin or zinc can be inserted between the two, and the upper part then lifted with the glass. Payne, however, says, "I have found the process much simplified by placing an empty box between the glass and the parent hive, and leaving it a few hours. The bees by that time have quitted the glass, and by this plan robbing is entirely prevented, whilst the bees are less irritated." It might occasionally happen that a piece of comb had been worked upwards from the underneath hive, thus causing a difficulty on attempting a separation. There is no better way of meeting such an emergency than by very gently passing a bit of fine wire or string beneath the lower edge of the super, from side to side, and thus cutting through the obstruction. It may be well to observe that on removal, the box or glass ought to be kept in its original position, to prevent the honey, which at first is thin and fluid, from running out of the cells, and especially in hot weather.

Honey Harvest.—As regards the quantity of honey to be taken from a hive in any one year, there can,

in our uncertain climate, be no general rule, though now and then I have known a very large amount obtained by deprivation. Payne says, as the result of his own experience with depriving hives, "It is usual to obtain from every good stock twenty or perhaps thirty pounds of honey annually." This would be thought too high an estimate in many districts; as in my own, near London. It must be remembered that honey thus harvested sells at a higher rate than that procured by suffocating the bees, as in the common single hives; for then the brimstone not only imparts a disagreeable flavour, but there is no means of preventing the intermixture with the honey more or less of pollen and brood.

After deprivation, the sooner the honey is extracted from the comb the better, as it soon thickens, particularly if not kept warm. The favourite process now adopted for the accomplishment of this consists in the use of the honey-extractor, to a description of which the next section is devoted; but those who object to the cost of one of these instruments, can proceed by slicing the combs with a sharp knife, and then inverting them in a hair-sieve. The honey will of course run off the sooner if placed before a fire, but exposure to heat is injurious to fine flavour. We may here resort to the advice of Payne, who says, "The honey should be put into jars, quite filled, and tied down with a bladder; for exposure to the air, even for a few hours, very much deteriorates its flavour. I may observe that honey in the combs keeps remarkably

well if folded in writing paper, sealed up to exclude the air, and kept dry."

The Honey Extractor.—It is only a few years ago that the valuable discovery was made by an Austrian or Hungarian bee-keeper (Von Hruschka) that honey could be slung out clean from the comb by means of centrifugal force; but from that date we have had quite a host of contrivances in one country after another for turning this fact to practical account. Every maker very naturally represents his own "extractor" to be either the best or else the simplest and cheapest; but without attempting to decide between their competitive merits, we will simply present to our readers one which we know to have been highly commended by others besides its inventor, and which, moreover, carries with it the special recommendation that that inventor gave it to the world without ever seeking to derive from it any pecuniary gain. We refer to the "Rapid Extractor," designed by Mr. T. W. Cowan, of Horsham, by whom we have most obligingly been furnished with the data for the following description, as well as with the sketches from which our blocks have been

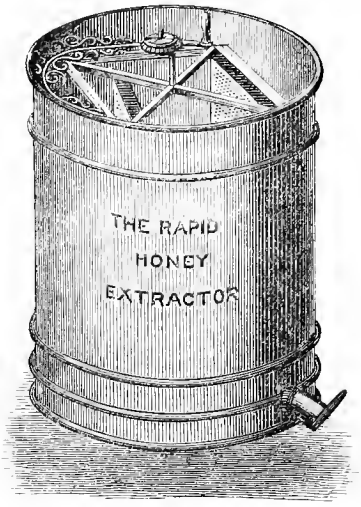


Fig. 1.

engraved. In general construction, as shown by Fig. 1, the extractor consists of a galvanised iron cylinder, with framework holding two wire cages, which reach down it some two-thirds; also a handle for producing the revolutions, which is fixed by means of fancy iron-work to the top of the cylinder, instead of passing through it by a spindle. The wire cages or cases will each contain one entire comb, from which the cappings must first be removed, and then, by turning the handle at the top, the honey upon the outer side of each comb is swiftly slung out on to the sides of the cylinder, from whence it trickles down to the bottom, which is made conical within, and allows of its being readily drawn off by the treacle-tap shown in the figure. For the further particulars we must turn to Figs. 2 and 3, the one of which shows the

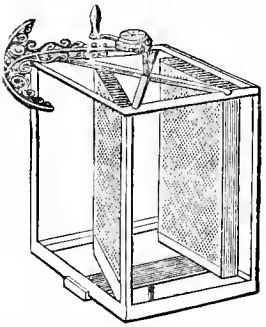


FIG. 2.

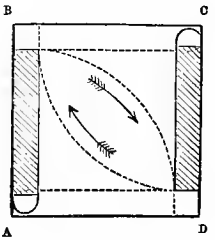


FIG. 3.

framework when removed, and the other a top plan of the same. In the latter the two combs in position for working are shown by A B and C D, each being hinged respectively at A and C (in Figs. 1 and 2 the left hand case is represented as slightly askew upon

its hinge). When, therefore, the honey is extracted from the outer sides of the two combs as thus placed, it is simply requisite to shift them in the directions shown by the curved lines and arrows, so that they take the respective positions of A D and C B. This, it will readily be seen, will cause the sides previously inwards to be placed without, and the handle being again turned, the emptying of the combs will now be completed. This simple arrangement, in default of which the combs would require reversing inside their cases, is the principal advantage claimed for Mr. Cowan's invention; while others are the simplicity of its construction and comparative impossibility of its getting out of order. Galvanised or tinned iron is the proper material for the cylinder, on account of its not affecting the honey. The price of 60*s.* is quoted by Mr. Lee, but those who care only for the plain essentials can get the instrument made much cheaper.

Honey-Knives.—A difficulty sometimes arises in extracting the combs from common hives or boxes. A large spatula will separate them from the sides, but to detach them from the top, an instrument of a different kind is requisite. The one often preferred is simply a bar of steel about fourteen inches in total length, half an inch wide, and an eighth of an inch thick. At one end it is bent at a right angle, so as to form a projection an inch and a half long, rather less than half an inch wide, and made spear-pointed, or lancet-shaped; sharp on both sides, to cut either way. The other end may have either a wooden handle, or another blade of

the spatula or spade form. Different makers supply several variations. For the purpose of uncapping the cells previous to insertion in the "extractor," a knife made by Messrs. Bingham and Hetherington is strongly recommended by Mr. Cowan.

Robbers.—Should an attack upon a hive from strange bees take place, which sometimes occurs at this season (the strong robbing the weak), no time ought to be lost in narrowing the entrance, for if the practice were allowed to continue a day or two, the ruin of the family might soon ensue. Indeed, it is always well gradually to make this contraction as the working season draws to a close. An assault from robber bees is often a much more formidable evil than one from wasps, although it is said that one of the latter is a match for three bees. Unless the colony is very weak, wasps are usually soon expelled, if the method pointed out at page 188 is resorted to. Not so with bees, for if but one or two strangers gain admittance into a hive, they will return again and again, always with an accession of force; and for a day or two it is often necessary entirely to close the entrance against them, opening it only at night. In such case the robber bees will sometimes collect in vast numbers at the mouth of the hive, when a shower from a watering-pot will send them away to dry themselves. The thieves are generally distinguishable, and they are often cunning enough to resort to their marauding practices early in the morning and late at night. A supply of syrup given on the top, or even sprinkled among the combs of contending hives, will often divert the attention of the combatants; or smoke

is sometimes effectual, puffed into both hives. If fighting recommences on the succeeding day, the smoking should be repeated, followed by a feed of syrup. Others have found it advantageous to remove for some days a plundered hive to a distance; or even to make the belligerent hives change places in the apiary; which, as a friend remarked to me, "gives a new turn to their ideas of *meum* and *tuum*." A German proprietor, after removing an attacked stock, put in its place a hive filled with wormwood leaves, which were so distasteful to the robbers that they forsook the spot, when the stock was brought back again.

Autumnal Feeding.—All labour is now usually suspended for the year, and it remains to see that ample provision is laid up for the coming winter and spring. Mr. Cowan has recently estimated (in his paper on "Wintering Bees," referred to more fully in the next chapter) that a hive consumes, on an average, an ounce and a quarter of saccharine food per day, or a total of about thirteen pounds during the period from the 1st of October to the 1st of March. But he reminds us that it would never be safe to supply the bees with only the bare quantity that they are certain to require, for upon any fall in the temperature the rate will be greatly increased, and unless the insects possess a superabundance in their combs, they are continually given to flying out in the winter. He would therefore consider it unwise to settle down for that season with less than from *twenty-five to thirty pounds* in the combs.

In ascertaining the weight of a given hive, Mr.

Taylor enforces the necessity of discriminating between an old and a new one, as in the case of the latter some eight or ten pounds more must be allowed, for old combs are much heavier than new ones, and besides, they are a good deal filled with stale pollen, and sometimes contain candied honey, of no use to the bees.* In a healthy stock there should be no scarcity of food, if the season has been tolerable. The worst, however, must be provided for, and, if necessary, the deficiencies of nature must be artificially met. Honey is generally too valuable to be given back to the bees, and in its place they are supplied with a syrup, which, as designed for *autumn or winter* feeding,† may be prepared on the following recipe, published by Mr. Cowan :—

White lump sugar	10 lb.
Water	5 pints.
Vinegar	1 oz.
Salicylic acid solution‡ ...	1 oz.
Salt	½ oz.

Boil for a few minutes. This syrup the bees will stow away in their cells at the rate of often a quart a day.

* In reference to this subject, there may still be some degree of use in the following estimate, as given by Dr. Dunbar: "A common straw hive weighs, when empty, from five to six pounds; an ordinary swarm about four pounds; the wax of a full hive of the current year, nearly two pounds; of the preceding year, at least three pounds; and the farina in the cells, not less than one pound [often a great deal more]; making in all about fifteen pounds."—*Naturalists' Library.*

† That for spring and summer use will require to be a little thinner, and a distinct recipe is given under the head of "Spring Feeding."

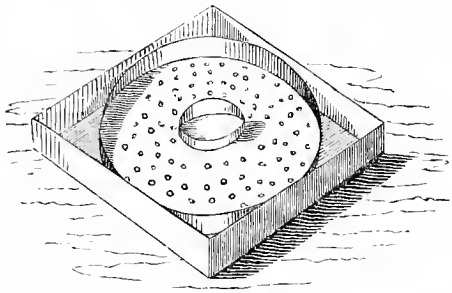
‡ In the section on "Foul Brood," at the end of "Winter Management," the composition of this solution is explained. It acts as an antidote to that disease, and is also useful in preserving the syrup itself.

The requisite feeding to make up the winter store ought not to be delayed later than the beginning of October, and the weather should be fine when it is performed. At that date, accordingly, each hive should be fed up to the standard of weight above stated, and, at the close of the same month, all syrup or honey found to be unsealed should be extracted from the cells (a practice of artificial sealing by means of melted wax brushed over the combs, has, however, been successfully carried out in Germany). Food must never be placed in the open air, but under a cover; otherwise, the smell would attract wasps, or, what is worse, strange bees; in the latter case, a battle generally following.

Feeding Troughs.—The feeding of bees, simple as it seems, is often a troublesome process, and without due precaution sometimes leads to a good deal of disturbance. The common swarming hives present much difficulty, from their construction. Having no opening at the crown, the clumsy and dangerous mode must be resorted to of bottom-feeding; either by tearing up the hive for every supply of food, or by means of successive strips of wood overlaid with food, and pushed within the flight-hole. An improved hive gives facilities for presenting food on the top, obviating these inconveniences, and allowing of its being supplied in any quantity without disturbance, at the same time that it is rendered wholly inaccessible to enemies.

When there is a hole in the centre of the top of the hive, a trough may be used, made of tin or zinc, seven or eight inches square and one inch and a

quarter deep, having a circular two-inch hole in the middle of the bottom, with a rim round the hole, standing up half an inch. This opening is to stand exactly over the feeding-hole in the crown-board, admitting the bees to rise through it and above the rim, so as to gain admittance to the surrounding



food. Another circular rim or partition, as large in diameter as the square of the pan will admit, is soldered within it at the four points where it touches the sides. It must not go down to the bottom, but a space should there be left of nearly an eighth of an inch, as a passage for the food, which is poured in at one of the four angles. A perforated thin wooden bottom or float is fitted loosely into the pan between the circles, removing an objection sometimes made against the chilling effects of metal upon bees, and also obviating the risk of their being drowned in the syrup. The float should be a little raised by means of two thin strips of wood appended below, to allow the liquid to flow beneath. A cover is made by a piece of glass resting on the larger circle, but cut

nearly octagonal in form, so as to leave the corners open. The circle on which the glass rests should be an eighth of an inch lower than the outer rim; the glass resting upon it will thus be five-eighths of an inch clear of the smaller circle through which the bees rise. In making a trough of this kind, it is sometimes customary to append beneath it a central descending rim or tube, fitting down into the hole on the top of the hive. This is worse than useless, and it is in the way on the removal of the pan; on which occasion it is expedient to push beneath it a piece of sheet tin or zinc, to stop the communication from below. Instead of the outer circle there may be substituted a simple partition at one corner going nearly down to the bottom, so as to cut off a portion at that corner. The glass pane can then rest on angle pieces, sunk an eighth of an inch, at the other three corners, and upon the partition at the fourth, this part being left open for pouring in the food.

A charge is sometimes brought against zinc feeding-pans as tending to create acidity in the food. There may be some truth in this, where the syrup is suffered to remain too long, especially if a general neglect of cleanliness coexists. Those, however, who prefer wood altogether, may have troughs made of that material, either square or round in form, cut or turned in a lathe from hard wood, a piece being divided off on one side by a partition, under which the food passes, beneath a wood float. A pane of glass may rest upon a circular rabbet turned out to receive it, leaving uncovered the part beyond the partition. The admittance from the hive can be contrived as before.

Feeders of the trough or saucer form are supplied by the makers in zinc, earthenware, and wood. But others are made on the principle represented on page 113, under the description of the Cheshire hive, and there is in their case a facility of regulating the supply of food, which has not yet been devised for the others. A common pickle-bottle answers the purpose well, from its wide mouth; if this is narrower, a support will be required to hold the bottle erect. The vulcanite plate there mentioned can be obtained by itself for application to any hive; in its absence, a piece of net must be fastened over the mouth of the bottle, and perforated zinc made use of besides. In the case of the vulcanite, it is recommended to scrape off excrescences that would prevent its passing smoothly under the mouth of the bottle, but to roughen it by scratches beneath, so as to afford a better foothold to the bees. "Two cautions," adds Mr. Cheshire, "are necessary: first, do not use over-large bottles, for the syrup to be filled at long intervals, as some have recommended. Air expands and contracts greatly as its temperature rises and falls, and that standing above the syrup in a capacious bottle, increasing in volume as the morning warms, will pour our food down over the bees, to their great injury, especially if the night has been cold. A bee-keeper of our acquaintance recently lost a stock from this cause..... Second, bees will often devour whole batches of eggs deposited under the stimulus of continuous feeding, if [afterwards] left without supplies for a few hours. This is more particularly true when the weather is such as to confine them wholly to their hives." This

second caution obviously refers only to feeding when the hive is nearly or quite without stores. The term "stimulating feeding" has reference to the object of bringing the bees forward, so that they may commence operations as early as possible in the season.

If the hive cover is not secure against the admission of robber bees, the bottle feeder will require some form of covering. A bell-glass will be quite effectual, but all that is needed is to protect the part round the mouth. Messrs. Neighbour have introduced a feeder on the same principle as the bottle, but in which this difficulty is done away with; the vessel consisting of a flat-bottomed tin can with five small holes closed by a valve. It has a screw top, and a strip of glass on one side, showing the height of the syrup.

The sooner the feeding is ended the better; the bees, if in health, being on these occasions much excited and often irascible. Let enough be given when you are about it. Gelieu says, "Let there be no higgling with the bees; better that they have too much than too little."* Recollect that little of your bounty is now eaten, but is conveyed and stored for the day of need; the bees sometimes extending the combs purposely to receive it, and often those of pollen as well; for it is observable that feeding even in autumn stimulates them to foraging abroad. Nothing is wasted, and whatever there is to spare

* This is no contradiction of the cautions given above, which referred to supplying food for immediate consumption. In reading of the quantities appropriated (whether of pollen or of honey) the beginner must avoid confusion between the actual feeding of bees, and their collecting of winter store.

will be repaid with interest in the spring. It must also be borne in mind, that what food is likely to be wanted must be supplied *now*, for very rarely, after the full weight has been attained, should any further attempts at feeding be made till the returning spring restores animation to the family.

Winter Store.—We have above mentioned the estimate as to the requisite supply of food for the winter. Anomalous as it may seem, it has been found that the quantity which is required is not dependent on the population of the hive. The number of mouths makes little sensible difference, even when two or three stocks have been united. This fact was first noticed by Gelieu. "In doubling the population," he says, "I naturally conceived that we must also double the quantity of food; ..... and, in consequence, I augmented greatly the amount of provision the first time that I doubled a hive; but, to my astonishment, when I weighed it again in the spring, I found that the united swarm had not consumed more than each would have done singly. I could not believe my eyes, but thought there must be some mistake; nor could I be convinced until I had repeated the experiment a hundred times over, and had always the same result."

This seeming anomaly has been partly accounted for by the fact that increased heat is in some measure a substitute for food. But in addition to this, the junction of stocks, alluded to by Gelieu, ensures a larger supply of labourers in the early spring. It is not in the cold weather that much consumption of food takes place, but after the month of February, when the great hatching comes on; and then not so

much by the *bees* as by the *brood*. In a thinly-populated hive, almost the whole family is required within doors at this time to warm the eggs and feed the young, and consequently little is added to the continually diminishing stock of honey and farina. Nothing is more common than to see a hive, apparently well stored in February, on the point of perishing in the month of April. This is not the case where a large number of bees can be spared to go abroad and bring in fresh supplies, to keep pace with, or even to exceed, the demands of the craving brood. Still the principal explanation of the mystery is evidently that given by Mr. Cheshire, who, regarding honey or its equivalent as expressly a *heat*-forming provision, treats the result as only a matter of course, and reminds us that on doubling the number of occupants of the same room, we should rather, if anything, *diminish* the consumption of coals.

It is also important to give attention to the supply of pollen existing in each hive. Those which have been in full work will often be found to contain an overplus of this article, in which case it will be better to remove a portion (by extraction of frames) to prevent mildew occurring in the winter. On the other hand, any hive which, from some exceptional cause, contains a short supply, should receive the frames or combs which have been removed from its overstocked neighbours; or, in the absence of such provision, recourse must be had to one of the substances mentioned in the next chapter under the heading "Substitutes for Pollen." Bees, as already noticed (page 184), require the building-up nutriment

which pollen supplies to recruit them from the exhaustion following their summer labours, conjoined with the sharpened appetites which a diminished temperature begets. They will cease to resort to it in the depth of winter, but immediately upon their return to activity it will become a primary requisite, and the so called "artificial pollen" will then be found an invaluable alternative. By that time, however, the hive may safely be opened, or themselves will be able to fly forth to appropriate the proffered supply; what is necessary now is to ensure their having sufficient to last till this period arrives.

Autumn Population.—The question of the number of bees contained in a colony as they are settling down for the cold season is no whit less important than that of the provision to be supplied them, the reasons for which will be fully stated at the beginning of the chapter on "Winter Management." Three main points are to be attended to: first, that there is a prolific queen; second, that the entire population is as large as possible; and third, that breeding is carried on to the latest date that can be induced. The state of affairs must therefore be frequently inspected, the queen, if necessary, being changed, and small stocks united together on the method explained in the following section. Sometimes it is found that by the middle of August the queen has practically ceased to lay, and consequently by the time that the great spring hatching is coming about, there will either be no living workers left in the hive, or the few that there

are will be incapable of nursing the brood. The continuance of breeding must therefore be ensured, at any rate, until October, and if its cessation is found to be occasioned by the filling of all the cells with honey, additional room must promptly be provided; whilst, if it is owing to a deficiency of stores, occasioning the provident queen to fear that there will be no sustenance for her brood, stimulating feeding must at once be had recourse to. For the substance of these remarks we are again indebted to the above-mentioned paper of Mr. Cowan.

*Autumnal Unions, Fuming, and Transferring Bees.**— The system of autumnal unions of bee stocks is one of the most important matters in modern bee-keeping, though it did not at first receive the attention it demanded, in part, perhaps, from the supposed doubt about maintaining the bees, when collected in a large body, through the winter. This difficulty, however, is removed by a reference to what was said on the subject of winter store in the last section. I hope I shall be able to show that, by a safe and simple expedient, the bees of two or three weak or worn-out families may be joined together to form one vigorous stock. The process should be undertaken about September, and in warm weather.

The custom of stupefying bees by some narcotic substance has long been in practice. By means of subjection to the fumes, the bees are rendered insen-

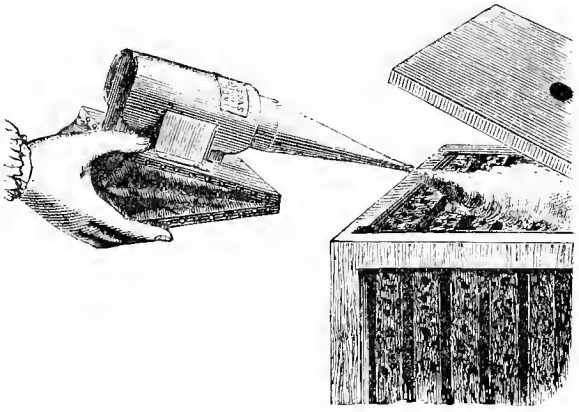
* It may be well in this place to call attention to the distinction between the system of transferring bees in autumn, in the way now pointed out, and that of transferring bees and combs together from one hive to another. Directions for the latter process are given under "Spring Management."

sible and harmless for a time, but soon recover, with no appreciable ill effects. Perhaps the most simple apparatus for fuming is that used by an Apiarian Society once existing at Oxford, and which consists of a tin tube, eighteen inches long and three-quarters of an inch in diameter, and readily made by any tin-worker. One end is extended and flattened to adapt

it to the entrance of the hive, whilst the other is applied to the mouth of the operator. In the centre of the tube is a box, two inches and a half long and two inches in diameter, to contain the fumigating material; to receive which, one end is made to draw out like a telescope. The two ends of the box where the tubes join it are stopped within by divisions of perforated tin. This part must be put together by riveting, and without solder, which the heat would melt. An instrument of this form is adapted for most purposes where smoke is needed, it being applicable to fuming a hive either at the mouth or from the top; for it is occasionally more in accordance with the object in view that the bees should be driven down rather than upwards. When, therefore, this is proposed, a bend in the tube becomes expedient, which is readily managed by having the farther end made in two pieces, to be disconnected at pleasure, like the rose of a watering-pot. Another end piece can then be slipped on like a nozle, and turned downwards, to enter the hole through the top of the

hive. The instrument just described is, of course, used in the hand; but another kind is sometimes applicable, made not unlike a pepper-box upon a foot, which stands on, or in a hole in, the ground, whilst the hive about to be fumed is placed over it. The top lifts off to receive the fungus, and both that and the lower end are pierced with holes. A common pair of bellows without any smoke will frequently answer every purpose when the object is to drive the bees downwards from the tops of the frames, as with the smoker shown in the next cut.

Messrs. Neighbour, who have fumigators of both the descriptions above named, have also lately added what they term the "Safety Smoker," an engraving of which, with their own description, is here appended:—

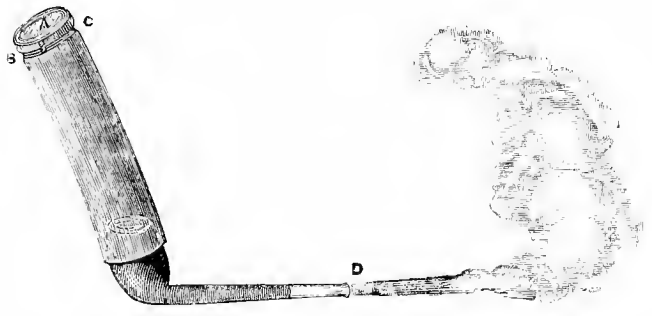


"The above engraving represents the smoker in use when manipulating with a bar-and-frame hive.

It consists of a long tube, which takes apart in the middle and has bellows underneath. The air is communicated to the tube through an upward valve. Fungus, decayed wood, or rags will answer. To prevent the fire going out when not in use, set the smoker down on end.

"The tin guard over the tube is intended to prevent the hand being burnt in case the smoker is incautiously laid hold of." The price is 5*s*. 6*d*.

Annexed is a figure of the "Cheshire Prize Smoker," sold by Mr. Lee (price 2*s*.). Its inventor



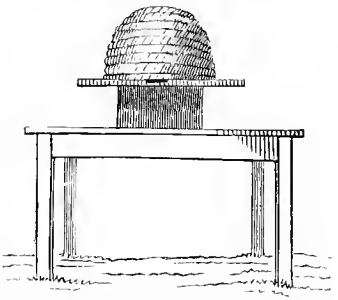
thus describes it ("Practical Bee-Keeping"): "A piece of india-rubber tube, about one inch in diameter, and six inches long, is fitted over the bowl of an ordinary pipe, rather brier-root than clay, while the end is closed with a wooden plug or short cork, tied well in with wire or string. If, after the pipe has been charged, a fusee be dropped into it, and the india-rubber tube placed in position, the hand can easily work the latter by alternately compressing and releasing it; at each squeeze a

stream of smoke will issue, and can be driven in any direction." The figure is self-explaining without the need of the letters added to it by the engraver.

The substance hitherto chiefly recommended for the fumigation or stupefying of bees is a kind of fungus, found in the autumn, growing often very large and round, mostly in rich pastures or plantations. It is the *Lycoperdon giganteum*, but in common parlance variously called, as Devil's snuff-box, fuzz-ball, or puff-ball. It should be gathered when nearly ripe. Dry it in the sun, or a cool oven, and preserve it from damp. It is then a spongy substance, containing brown dust, and burns with an offensive smell. The frequent difficulty in procuring this material led me to make trial of another kind of fungus, called *Racodium cellare*, or mouse-skin *Byssus*. It may be found growing in large wine or beer vaults, in immense dark-coloured bunches or festoons, suspended from the roof, often wearing a handsome appearance. In a single such vault in London, I have seen as much as would suffice for a large portion of the bee-keepers in Great Britain; and I can recommend it (not too freely used) as even more efficacious than the other fungus. It requires no preparation, igniting and smouldering readily, and may be preserved for years.

The use of smoke and the fumigator is in request for nearly all operations with bees; but in effecting the union of colonies the process is pursued till it not only repels and quiets, but absolutely deprives them of consciousness. The hive which is by this

means to be emptied of its tenants may be lifted gently from its place soon after dusk, and placed over some kind of receptacle. An empty hive, turned bottom upwards, might answer with a little management, but there must be no place of escape for the bees. The best thing is a box or bowl, about ten inches square within, and four or five inches deep; with a wide flat rim all round. The box of the fumigator should be about two-thirds full of whatever material is employed; and a few puffs will cause it to send forth smoke abundantly. The first introduction of the smoke will cause an uproar among the bees, which will speedily be followed by silence, as they fall down from its effect. A minute or two generally suffices for this, assisted by striking the sides and top of the hive. When all is quiet, turn up the hive (taking care to move it in the direction front and back, and not across the combs), and you will have received the greater part of its inhabitants in the bowl, in a stupefied state and perfectly subdued. A portion will remain sticking in the combs, and as many of these as possible must be swept with a feather into the bowl, where a little more smoke will, if needed, keep them quiet in the interim. With a frame hive every bee can be transferred by the simple extraction of the frames one by one, and shaking off of



the occupants into the bowl; no inversion of the hive will here be requisite, nor is even the removal of the insects when the frames are interchangeable, as explained below (page 224). As respects the queen, if perceived, she can be taken away, but the bees will commonly dispose of her in their own way by the next morning. The search for her is greatly facilitated if the whole stupefied family are emptied on to a sheet, restoring them to the hive when she has been found.

The whole being thus collected, they soon begin to show signs of returning animation; and when this is about to take place, sprinkle them pretty freely with a mixture of sugar and ale, to which may be added a few drops of peppermint. Next, lift quietly from its stand the hive to which the smoked bees are to be united, placing it over the bowl, but leaving no opening except the mouth, for air. The bees from above, attracted by the scent, will go down, and begin licking the sprinkled ones. The whole thus become intermixed, and afterwards ascend together into the hive over them, in perfect goodwill. Leave them till the following morning early, when the bowl will generally be found empty. Replace the hive, with its doubled population, on its original stand (or whatever position may be assigned it, see page 226), and the work is complete. If it is thought desirable still further to augment its strength, the bees of a second hive may be added in the bowl; or a second union may be made in a night or two afterwards. Yet again, a stupefied swarm may be divided between two hives, and three colonies thus

reduced to two; the stupefied colony being first divided into two portions, one of which is set aside in an inverted and covered skep, or any secure receptacle, whilst the other is subjected to the uniting process. All that remains is to see that each hive, as now made up, contains honey to last the winter; and whatever is wanting must be supplied for that purpose, in the way pointed out under "Autumnal Feeding." As to the brood in the deprived hive, see the final paragraph of this section (page 229).

We will now detail another mode of proceeding, at once speedy and efficacious, and attended with no risk to the operator. In the evening puff some smoke into the mouth of the hive you wish to empty, without removing it. Compel as many of the bees as you can to fall down; then lift the hive, and brush out those remaining; taking away the queen if you can find her without much trouble. Collect the whole in a heap on the floor-board, and sprinkle them pretty well with sugared ale. You may now, if the numbers are still thought insufficient, add to the first the smoked bees of a second hive. Next, in a quiet manner, and without removal, puff some smoke within the stock-hive into which the bees thus collected are to be transferred; just sufficient to stupefy its inhabitants, and produce a uniformity of scent. Turn it bottom upwards (with the same precaution as above), floor-board and all, so as to drop no bees; and place it, if of straw, in a pail, or some similar kind of support. In this position lift off the floor-board, and sprinkle these bees also with

a smaller portion of the ale, in the hive where they are. After this is done, before they have recovered, sweep the smoked bees uniformly among the combs of the hive destined to receive them. Clean and scrape its floor-board, and as soon as symptoms of returning animation begin to appear, replace it, turning the whole again into the right position. All that remains is to station it at once in its allotted place or stand. Before the hive is left, clear away from the entrance any bees that may have fallen down, so that the passage for air may not be obstructed. In the absence of fumigators like those described, it is very practicable to make use of a common pipe and tobacco; but the latter should be of a mild kind, and not too freely used, or many deaths might ensue.

Some apiculturists are expressing strong objections to the entire practice of stupefying bees—maintaining that it is most injurious in itself, by weakening the powers of the workers, and, through the queen, affecting future generations. It may readily be conceded that to get into a state of helpless unconsciousness is not a salutary proceeding, either for bees or their masters; but in reference to the former we use the term "anæsthetic" instead of "intoxicant"—indeed, the anæsthetic chloroform has been used in the process by some—and whether there is any radical difference between the physical effects of the two agencies or not, the change of words gets rid at least of an ugly association. Still, it may be taken as advisable that the operation should not be needlessly prolonged,

nor yet repeated with the same bees (or the same queen) whenever it can be avoided. Particularly is this to be urged when tobacco is used—indeed, the Baroness von Berlepsch sets down the use of this drug as one among the superinducing causes of foul brood. Now the process of uniting colonies is one that is extensively accomplished without the stupefying process. One of these is described by Mr. Taylor in the following section, and another is regularly practised in the use of the Stewarton hive, with which, as we have seen, all that is done is to bring the two swarms into contact with each other in the night-time—a method, however, that would be unsafe with settled stocks. The editor may be allowed to quote some general observations on the subject, which were inserted by himself in the third edition of Neighbour's "Apiary," and founded, in the main, upon a number of detached remarks by Mr. Langstroth :—

"After working hours is the best time for this operation. It is not, however, altogether a simple one, as strange bees will not intermix unless measures are taken to overcome their natural hostility to each other. Whatever be the number of hives in an apiary, the bees of each know the smell of their own companions. A single bee that enters the wrong hive will be stung to death, unless possessed of a good booty wherewith to disarm animosity. Similarly on the admixture of entire colonies, if one has some distinct ground of advantage over the other, there must be a method hit upon to deprive it of this, or else to purchase its goodwill, for

otherwise there will ensue a ferocious and disastrous slaughter. If both are alike frightened all will go well, and the same if both are upon the wing in search of a home; but quite otherwise if one is self-possessed and active in its own abode, while the others are frightened strangers and gorged, and it may be still further demoralised by having lived under an unfertile queen, or with none at all. But if both are cowed alike by a good drumming on the hives, they may be sprinkled so as to possess the same scent, and then taken to a third position and shaken out on to a sheet together, when they will enter the offered hive in harmony. If each colony has a queen, and a battle royal is not desired, one of them must be searched for and removed."

With frame hives, if the frames will interchange, a little smoking and sprinkling are administered to each, and then the frames containing bees in the one can be substituted for empty ones in the other: indeed, in this instance, the brood will be transferred as easily as the bees. But, if the two hives have frames of different sizes, then the bees must be brushed from those of both hives on to a sheet, and there sprinkled a little more, and then introduced to their intended home.

It may not be misplaced here to remark, that, in the language of apiculturists, the hives of the year, *made up*, as it is termed, for the winter, now assume the name of *stocks*. Hitherto they have been denominated swarms. At this time a good selection of stocks for removal at Christmas may be made by those about to establish an apiary. In addition

to the usual characteristics of vigour, such families are to be preferred as exhibit a certain degree of irascibility, for this is often most observable where there is most to defend.

In selecting the future domicile of the family augmented by the uniting process, it will be well to take care that the hive is not one of long standing, in which the combs have become thickened by age. Indeed, a colony of the same year is to be preferred, and more particularly where the queen is a young one. If, however, it is desired to cut out the old combs from the intended future stock-hive, this can now be done with safety; first turning on to the board as many of the bees as you can. A supply of food will invigorate the new community, and the vacancies will be filled up with fresh combs, provided the operation has not been delayed too late in the season.

It is of great importance here to observe, that after making autumnal unions, in cases where the bees have been expelled from hives possessing fresh combs, the latter ought to be left undisturbed, as so much gain to a future spring swarm, which will gladly accept a house ready furnished; moreover, a vast saving of honey results, for the fabrication of comb, as we have shown at page 176, consumes a great deal of this. The same remark applies to supers partly filled with combs; but they should be kept clean and dry. It is worthy of remark, that some authorities maintain the opinion that bees will now and then re-work *portions* of old combs, but these must be free from impurity.

As far as it can be managed, it is desirable that attention should be paid to the previous position of the hives intended to form unions, for there is always a disposition in bees to return to the spot to which they have been accustomed. Where it is practicable, therefore, it is best to unite adjoining families, and, if a few yards apart, to place the doubled colony midway, removing the emptied hive entirely; or when the union is to consist of three, to unite to a hive in the centre, one on each side. But as this cannot always be arranged, it is highly advisable to gradually shift the colonies nearer to each other by movements not exceeding a yard per day. A little foresight as to the arrangement of the hives, exercised at the time of swarming, will often facilitate after proceedings. Some have resorted to the plan of confinement of the bees, but this does not always meet the difficulty; for, on the first opportunity, many of them will return to their old haunts, and seek in vain their former dwelling.*

Fumigation may often be resorted to in cases where a superabundance of honey exists in a stock-hive at this season; for after the introduction of a little smoke the bees will fall down. The dwelling may then be reversed, and a portion of comb cut away in due moderation. Restore the bees to the hive, and replace its board, when the whole may be turned back to its proper position without injury. The extreme outside combs will be the only ones whose honey is pure enough to take.

* Mr. Cheshire, however, says that this danger is passed by the third day. Our author's statement must be modified accordingly.

With frame hives, of course, this operation will be simple enough.

Under the head of "Common Straw Hives," we remarked upon the usual mode of obtaining possession of the honey by means of suffocation with brimstone; the stocks of the second or third year's standing being commonly the ones selected for destruction. If, however, such stocks can be made strong and healthy in the way we have been detailing, good policy would point to the colonies of the present year as those affording the richest harvest of honey, and that of the best quality, as being in new combs. These will never be of more value for the market than in the first autumn. Such of the older stocks, moreover, as have sent out swarms in the past season will of course possess young queens, and this fact will give them also an advantage as to the quantity of their stores. Under any circumstances, it is clear that in gaining possession of the honey, destruction of the bees may be avoided by adopting the fuming and uniting plan, instead of that of suffocation; for whether the hive be new or old, rich or poor, the same principle applies, with no amount of time, trouble, or expense, greater than under the brimstone system. The plea of necessity no longer exists for a wanton waste of valuable life; and to this point the attention of the cottager, in particular, might surely be directed, as one often involving his future profits. Let him know that it is his interest *not to kill his bees;* but, when expelled from one hive, to unite them to another, where augmented numbers will require no more

than the usual stock of winter food. Inform him that he is acting on a mistaken principle when he imagines that his bees are worn out with age—the common plea for destroying them; tell him that the insects are short-lived, and periodically renewed, so that the *colony* alone becomes old; moreover, that a large proportion of the bees at the close of the season are those produced in the later months; the older ones gradually disappearing in the autumn, to be succeeded by others destined to become the early labourers of the opening new year.*

As remarked already in the section on "Autumn Population," it must not be imagined that all the bees collected together at this time to form a stock, are destined to survive till the spring. The day of life may, with many of them, be already far spent; but we have shown in what way their presence, though but temporary in the hive, indirectly contributes to augment the numbers of future spring labourers. However numerous may be the eggs laid in the spring, a portion only are of avail in any but a hive so well peopled as to create a favourable temperature for hatching them, and to supply the means necessary to their full development. Thus strength in one year begets it in succeeding ones; and it must be remembered how influential is warmth to the early productive powers of the queen, without which all goes wrong; and also how important it is in the opening spring to be able to spare from the home

* In many cases where proprietors have been obstinately bent on the old mode of destruction, the bees have been stupefied by wiser neighbours, taken home by them, and added to weak stocks of their own, which have turned to good account in the following spring.

duties of the hive a large number of collectors to add to the stores, which would otherwise not keep pace with the cravings of the rising generation.

Following up the principle thus laid down, I entirely agree with those who carry it out still further, by never destroying, if it can be avoided, the brood often found in quantity in a hive treated in the way we have been advising; for it is obvious that the latest-hatched bees are those most likely to be of use in the spring. Where it is practicable, therefore, those combs which contain brood should, with as little loss of time as possible, to avoid chill, be arranged in a natural position, in a frame hive requiring to be strengthened, or, if this is impracticable, in a well-covered super placed over the hive. In the latter case the bees from below will ascend and cluster upon the brood-combs, and in due time a valuable accession of numbers will result. A deprived frame hive offers many facilities in such cases, without injuring the combs.

Driving of Bees.—In the preceding section we have detailed the modes in practice either for uniting bees or for obtaining possession of their honey by the aid of *fumigation*. Many proprietors, however, prefer to arrive at the same object by resorting to what is termed *driving;* by which process the inmates of one hive are impelled to abandon it, and enter some other. When skilfully performed, this operation is often successful in attaining the end in view; but it is seldom well to attempt it except in a pretty full hive. Mr. Golding has given, in a small compass, general

directions as to the mode of procedure in common cases of driving, and we will therefore adopt his words. "Towards dusk, when the family will be all at home, let the hive be raised gently from its floor-board, and supported on wedges about half an inch thick. When the bees shall have quietly ascended from the floor up into the hive, it may be inverted steadily on a small tub or pail. An empty hive, of the same diameter, being at hand, should be quickly set over the one turned up to receive it [the colony]. A lighted pipe may be ready to give a puff or two if necessary, but the operation can generally be effected without using it. Tie a cloth firmly round the junction of the hives so that the bees cannot escape. Proceed to drum upon the full hive (opposite the sides of the combs, so as not to detach them) with the open hands or a couple of sticks; the bees will be so alarmed that in a few minutes they will have ascended into the hive set over them. A hive full of combs, and well peopled, always drives better than a weak and partly-filled one. The operation should never be attempted excepting in warm weather. If the object be to furnish another hive with the bees, there is nothing to do but to reverse the hive in which they are, and place the other upon it, again tying the cloth round the junction. A few raps upon the peopled hive will cause them to ascend, and early next morning they should be placed upon their usual stand. Those who still adhere to the common cottage hive may, by driving, deprive well-stored families of part of their honey. Having previously

weighed the hive, calculate how much may be taken with safety, and cut away the external combs accordingly. The bees may then be returned." Some operators vary the above proceeding, and perhaps diminish the danger, by placing, as the first step, the empty hive at the bottom, and the full one gently upon this. After making the junction complete between them, the two hives are reversed carefully together, so that the unoccupied one comes to the top, and the drumming then proceeds. This should be continued from five to ten minutes, according as circumstances indicate its necessity.

There are diversified ways of uniting the bees after they have been driven into an empty hive. Dr. Dunbar says, "Turn up the stock-hive which is to receive the addition to its population; with a bunch of feathers, or a very small watering-pot, drench them with a solution of ale and sugar, or water and sugar, made a little warm. Do the same to the expelled bees; then placing these last over the stock, mouth to mouth, a rap on the top of the hive will drive them down among the bees and combs of the underneath hive. Place this last on its pedestal, and the operation is completed. The strong flavour of the solution will prevent the bees from distinguishing between friend and stranger."

Payne advocates the middle of a fine day as the best time for driving; removing the hive to be operated upon to a shady place, and then inverting over it an empty hive, as already described. A little smoke might sometimes be needful. Having ascertained that the bees have gone into the upper hive,

Payne continues: "Take the latter immediately to the place where the driven hive was taken from, and place it upon the same floor-board. Carry the driven hive fifty or sixty yards away; the few bees that remain in it, as well as those that are out at work, will return to the other hive at the accustomed spot. All is now finished until an hour after sunset (excepting emptying the driven hive of its store), when two sticks may be laid upon the ground, about nine inches apart, opposite the stock-hive to which the driven bees are to be joined; then with a smart stroke dash out the bees between the sticks; and instantly, but gently, place the stock-hive over them upon the sticks: leave them for the night, protecting them from the weather, and an hour before sunrise restore the stock-hive to its original position. Here will be an increased population, enabled to stand through the winter much better, and to send out an earlier swarm, than if the union had not been effected."

The autumnal driving of bees is a common practice when the proprietors reside within a few miles of the moors and heaths, to which the hives are conveyed in time to luxuriate in a second harvest of blossom from the heather. In such districts, it is not unusual to appropriate or transfer the whole contents of the driven hive; the bees being compelled to begin the world again in a new house and locality, like a recent swarm. Two or three small families may be better driven into one. In a good season, a few weeks suffice to enable them to fill their second dwelling with combs, brood,

and honey of the very finest quality. On their return home from the moors, some of the hives are again driven, and deprived of a portion of their stores; or united in many instances two or three together, to form strong families as stocks; for the value of population is too well understood to allow of any unnecessary destruction of life.

Condemned Bees.—We cannot forbear from appending an excellent piece of advice on this head from Mr. Cheshire's book (under Calendar for September): "Condemned bees may now be purchased, and treated as explained above [the directions were to drum three or four skeps into one, transfer to an empty hive, and feed well till they reached the proper weight; pollen, real or "artificial," being supplied by shaking it into an empty comb held horizontally]. Whilst drumming bees for yourself, explain to the owners the method, and show them the folly of destroying the little labourers in the sulphur-pit. You may not be able to make bee-masters of cottagers in one lesson, but you can let in some light, and may be, as we have been, gratefully thanked for your kindness, while your willingness to buy what the old system destroys, is an unanswerable argument that there is waste somewhere." To this we may add a remark of Mr. Cowan, that "driven bees fed up in the autumn invariably make the strongest stocks the following season, for the simple reason that as they are obliged to make new comb, breeding is kept up later, and the population is a young one."

WINTER MANAGEMENT.

The management of bees in the winter season is probably that which is least understood of all the departments of the apiary, and various have been the modes urged for ensuring safety through its manifold dangers. It seems, however, to be pretty generally admitted that it is better to allow the hives to remain in their usual position throughout the year; and our care therefore should be directed to warding off the casualties now to be guarded against. Ignorant attention, nevertheless, is sometimes worse even than neglect; and having once made the needful winter arrangements, there ought to be as little subsequent disturbance as possible. The great points to be observed are, adequate exterior covering and complete protection from the effects of wind, wet, and sudden changes of weather; a sufficiency of food to last till the spring, with supplies of water as often as required; and preservation from damp in the hive, with full regard to the laws of ventilation. As regards the store of food, we have already said that this is a matter to be clearly ascertained and looked after in autumn. When, therefore, as the cold weather sets in, the bees have collected and clustered together, there must be no more attempts at feeding. The mouth of the hive should gradually be contracted, as the winter advances, though never entirely closed. After every fall of snow, let it be cleared away from the

hive, and about the stand or house, to prevent the chance of reflection, which always injuriously arouses the bees, and also for better security from the moist exhalations incident to thawing.

Since the original draft of this chapter was in type, our attention has been attracted by a valuable paper upon "Wintering Bees," which was read by Mr. Cowan, of Horsham, to a recent meeting of the British Bee-Keepers' Association. The greater part of his recommendations we have been glad to incorporate into either the following or the preceding pages, and to the above preliminary statement of essential conditions we have first to add the necessity of keeping up the temperature as high and as *even* as possible, and the paramount importance of a large population, which can only continue such by commencing the winter with a goodly number of *young* bees. This latter item is obviously a practical consideration for the summer and autumn; what is here to be remarked upon is its value in a theoretical point of view, and the manner in which its phenomena and the temperature of the hive act and react upon each other.

We have already stated and accounted for the apparent paradox of a large colony requiring no more winter sustenance than a small one. There is hence everything to be gained and nothing to be lost by collecting as numerous a population as the hive will contain. In winter we know that our insects live several times longer than they do in the gathering season, and consequently it might follow that a colony of exclusively summer-hatched bees would live

on till the return of breeding-time in March. But to ensure so protracted an existence it is necessary that they should be subjected to absolutely no exertions; whereas, when, with all our best efforts to avoid it, the temperature now and then does fall, much labour to the bees is entailed in the process of keeping up a sufficient heat. There should be an ample youthful progeny in the hive to undergo this toil; otherwise, even if the elder bees did manage to live on till laying recommenced, they would hardly sustain the further labours of hatching and rearing the brood, and the hive would be doomed to speedy extinction.

It follows from the cardinal fact above alluded to respecting the consumption of stores, that the larger the colony, the less will require to be consumed by each individual bee. And the less each bee consumes, the less of a variety of evils ensue. There is less of the activity which feeding begets, and hence less of the consequent shortening of life; while the very presence of the large population, by itself increasing the temperature, renders the need for this activity still less. There is less excretion in the hive, and at the same time less fear of dysentery from its enforced omission; and there is less exuding of moisture from the bodies of the insects, and less carbonic acid to vitiate their atmosphere.

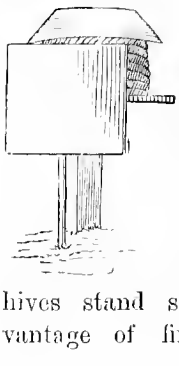
The closest connection exists between these considerations and that of the temperature maintained. The higher and more equable the temperature, the less will be the requisition for food or for exertions; whilst if the hive is allowed to become too cool,

the increased exhaling of vapour entailed by extra feeding will cause a condensation upon the combs, possibly to be followed by a freezing over of the honey-cells, and hence starvation of the insects, or else a subsequent thaw, begetting mould and fungoid growth. Apart, also, from the increased danger of dysentery from the larger consumption of food, the very cold itself renders it impossible to the bees to retain their fæces, and they void them over the combs, thus contaminating the air of the hive, and engendering further sources of ill.

The foregoing is a reproduced analysis of what may be regarded as the science of Mr. Cowan's paper. The practical deductions thence derived we have freely included under the following sections, as well as under those on "Autumnal Feeding" and "Autumn Population," which have already been presented to the reader.

Winter Position.—It is extremely desirable in winter to keep off the influence of the sun from the front of the hives. Some persons recommend moving them from their summer position to a north aspect, or turning them round on their stands. But this shifting of quarters seems to involve the necessity of retaining the bees close prisoners, lest such of them as casually left the hive might fly back to the original familiar spot, never more to revisit home. I entirely agree with those who assert that bees are never healthy where confinement has been long continued. "Who shuts up the wild bees in the forests of Lithuania, where they thrive so well?" asks Gelieu. Surely in this, as in other

parts of our practice, we cannot do better than follow the guidance of nature. On a fine day, with the thermometer at or not much below 50° (and such days are not of unfrequent occurrence in winter), the bees avail themselves of it, sallying forth in evident delight, with certain advantage to health and cleanliness; for they void nothing in the hive, unless compelled by long necessity or by cold. This is the point at which disease commences: indeed the retention of their fæces sometimes occasions death. Their impatience of confinement is excessive, and increases as the season advances, so that they will leave the hive at a lower temperature after Christmas than before. But in thus advocating the principle of liberty, I am not insensible to the evil it may bring with it, if not guarded against. The most disastrous consequences follow the flight of bees on a frosty day, when the gleams and deceitful warmth of a winter sun reach their domicile, particularly with snow on the ground, the glare of which lures them out to destruction, for they soon fall down to rise no more. The remedy for this is the screening of the hive in some way from its effects; and it should be done as soon as winter actually sets in. At the same time it is important that no obstruction to the free passage of air be presented, or dysentery among the bees would be the certain consequence. Where the hives stand singly, I have always seen the advantage of fixing before each a wooden screen,



nailed to a post sunk in the ground, and large enough to throw the whole front into shade. This does not interfere with the coming forth of the bees at a proper temperature; and it supersedes any necessity for shutting them up when snow is on the ground. The screen should be fixed a foot or two in advance, and so as to intercept the sun's rays, which will be chiefly in winter towards the west side. Other plans have been tried for effecting the same object, such as blocks placed at the mouth of the hive; but these answer no good end, as the rays of light penetrate underneath and around them. In a bee-house, entirely enclosed at the front, the hives and their boards may sometimes at this season be advantageously shifted a little sideways of the exterior entrance-way; with hollowed blocks (see page 151), shaped in accordance, to intercept the light, but not the air.

A screen of the kind we have described has the further tendency to promote the security of the bees, where other enemies than wind, frost, snow, or sun might sometimes endanger them. One of these, at this time, is the blue titmouse, to which we have before alluded. Old Purchas says, "She will eat ten or twelve bees at a time, and by-and-by be ready for more. When she cometh to the hive and findeth none, she knocketh with her bill at the door, and as soon as the bees come out to enquire the cause, she catcheth first one and then another, until her belly be full." At page 187 we have described a mode of dealing with these marauders.

Internal Arrangements.—It should be observed that,

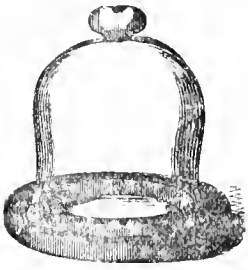
as the inner combs have been employed wholly for brood, they will now be almost destitute of honey. With frame hives, therefore, the outer ones, or at least such of these as are without drone-comb, should be transposed to the centre, that the cluster of bees may be supplied with provisions close to themselves. The outermost of all are better removed altogether, and the interior dimensions contracted by means of dummies. Also, in order to save the bees from having to pass round the cold ends of the frames, to avoid which they will sometimes prefer to be starved, it is necessary to cut a hole, an inch in diameter, in the centre of each comb, about one-third from the top. Within each of these winter passages, says Mr. Cheshire, place a coiled shaving of wood, which will prevent the bees from filling it up with comb.

Mr. Taylor remarks that "hives with flat roofs have sometimes been objected to, and perhaps justly, where no provision is made for ventilation." Mr. Cheshire admits that the skep possesses an *à priori* advantage over the frame hive for wintering, but on the ground of warmth rather than of superior ventilation. The combs in the skep, he reminds us, are attached not only to the top, but to the sides of the hive, so that the bees between two combs are completely shut in from draughts. To put the two on a par, and obtain warmth together with porosity for the wooden frame hive, he recommends placing between the frames and the crown-board a double or triple layer of the kind of matting used for fish-baskets, and known as *bast* or *frail;* a folded sack will cover the whole, and then, if the

crown-board will not rest conveniently, a box without a lid may be inverted over the hive. This last arrangement will allow of the substitution for an empty sack of a canvas bag, which is to be stuffed with chaff, or better with the broken dried fronds of the common braken fern (a recommendation of Mr. F. R. Jackson, of Slindon). Further, to close the gaps at the ends of the frames, Mr. Cheshire hangs strips of wood, three-quarters of an inch wide and about five inches long, from the zinc runners upon which the frames rest.

Damp in Hives.—Upon this point we may first repeat an instruction of Mr. Taylor, which is not materially altered from what he left it in the last edition. Perhaps, he remarks, there is nothing more prejudicial than the moisture often engendered in exposed hives at this time, particularly after frost, and in certain special states of the atmosphere. It accumulates on the top and sides, moulding the combs and rendering them offensive, and producing disease amongst the bees. Gelieu obviated the evil by placing caps or small hives (cemented down) over the stocks; the moisture ascending, evaporated through the opening, "as by a chimney." I have tried different experiments, and have found nothing better than the practice of condensing the vapour of the hive as much as possible, and conveying it away. At the beginning of winter, over the hole on the top, a piece of perforated zinc or wood is placed. Upon this let one of the common feeding troughs, already described, be put, from which the glass cover, and, if you please, the perforated

bottom, are previously removed; the hole in the pan being placed over the one below. This may be covered with a bell-glass, standing within the pan. As the exhalation rises from the bees below, it is condensed on the glass, and received, often in considerable quantity, in the pan. When there is no feeding pan, a bell-glass may be put within a circular leaden or zinc trough, having the centre open. The hole at the top of the glass may be stopped, opening it occasionally on a fine day, to allow the escape of vitiated air. The change of air in a hive, in mild, dry weather, is always conducive to health, till the early spring breeding begins, when caution against chill to the bees is needed. It is well to give to all hives or boxes a slight inclination forwards, as being useful in conveying away the moisture.



We have not thought it advisable wholly to omit this direction of our author's, but bee-masters of the present day do not regard it as more than partially remedying the evil. The largest bell-glass ever used in apiculture is much too small to collect the vapour often arising from the hive. A glass bar super or an observatory hive, similarly placed within a trough, would meet the requirement far better; but as bee-keepers seldom keep many of these, we find Mr. Cowan recommending a simple (wooden) super of the same size as the hive. This, however, is only one of the expedients adopted either by him or by

others. We have above referred to the use of covers of bast matting, the natural porosity of which permits of ventilation without any necessity for a condenser or vapour-room. In making use of a covering of this nature Mr. Cowan ensured a passage-way to the bees over the tops of the frames by means of splints of wood five-eighths of an inch thick, and reaching across the bars as far as the insects were likely to pass. This quilt, he tells us (for he employed drugget), should hang half-way down over each end of the hive, when it will act on the syphon principle so as to carry away the moisture.

But damp exhalations are not the only evils which ventilation is required to meet. Vitiated air, or in other words carbonic acid gas, as the product of the insects' breathing and perspiration, has to be got rid of, and either of the above measures is effectual also in answering this end. The porosity of the bast gives it an advantage over arrangements involving the opening of holes or leaving of crevices, by propping up the crown-board, or setting its divisions slightly apart, inasmuch as by the use of that material the draughts from the flight-hole to these openings are reduced to a minimum, if not altogether done away with. To open a feed-hole which would place the cluster of bees in a direct line between it and the entrance, would obviously be a most ill-judged proceeding; but on the contrary, if the cluster is confined by dummies to one end of the hive, while the opening into the vapour-room is made at the other, there will be no mischief to apprehend. There is no

purpose in contracting the flight-hole, say, closer than half an inch, for the strongest draughts come always from the narrowest chinks, whilst unless we have openings both at the top and bottom, the work of ventilation will itself be nullified. The object of narrowing it in winter is rather to diminish the danger of invasion from enemies; and the adjustment once made at the commencement of the cold season is better left unaltered till that season is at an end. The same rule should be observed in regard to the crown; but as soon, it may be in January, as days arrive when it is warm enough for the bees to fly, it is most advisable to take every opportunity of raising this, or rather its end pieces if divisible (as is now the case in nearly all well-made hives), or of lifting the ends of a quilt or matting, or withdrawing slides when such are present. Mr. Cowan speaks of having occasionally resorted to the somewhat startling expedient of propping up the entire hive an eighth of an inch above its floor-board, thus doing away entirely with the strong draughts from the flight-hole; but he has since explained that he did not attempt this bold measure with hives placed wholly out of doors. And although Mr. Cheshire tells us of having received his *first swarm* in 1876 "from a hive which had remained open from the previous autumn along its whole front, the front wedge beneath the bottom-board having been left out," he does not elevate the occurrence into a precedent, nor does he tell us that the "consumption of coals" in that hive underwent no consequent increase.

Temperature.—Under this heading we have said most of what is requisite in the introductory paragraphs of this chapter. We have just to add that bees when clustered together should maintain a temperature as uniform as possible of 65°. The following remarks of Mr. Taylor's, though partly inaccurate, may still be preserved: "With good protection from cutting winds, from wet without, and from damp within, the effects of cold alone, unless of extreme severity, need not be apprehended, for the bees of a strong stock will generate sufficient warmth; and a dry season is often better sustained than a mild, moist one. It is of importance to guard against those *sudden changes* of temperature which often occur in winter; and experienced bee-keepers have recommended covering each hive with a mat, or something of the kind, as a regulator.

"It is certain that less food is consumed at a low than a high temperature, and that the bees are often healthy in proportion.* I have known the thermometer down to 32° in a box, with no bad effect to the bees when *clustered together;* but they would become torpid if exposed *singly* to this, or to a much less degree of cold, especially towards the close of winter; and could then only be recovered

* It is marvellous how Mr. Taylor can have fallen into such an error. It is not the cold itself, but the semi-torpidity produced by an extreme degree of that cold, which lends the only particle of accuracy to a statement opposed alike to science and fact, as will be at once evident to anyone who thinks of his own appetite upon a cold day. As to the absence of any bad effect when the thermometer stood at 32°, we must interpret it that the bees got through the risk at the time by dint of extra feeding and exertion; but how about the after effect of these upon the duration of the insects' life?

by artificial warmth.* The action of very severe frost, moreover, has an injurious effect upon the honey, which becomes candied at the extremities of the combs, and sometimes throughout. It is thenceforth useless as food for the bees.†

"A thermometer is not always a criterion of the state of the hive at this season, as I have often found; for the temperature varies as the bees recede from this, and they frequently shift their quarters, moving in a mass to preserve the warmth. When congregated immediately about the thermometer, I have known it rise as much as 30° on a frosty day; and an increase of temperature always follows any commotion, or partial activity in the dwelling."

Inspection of Stores.—We have stated above that winter is not the season for supplying food, but if it should be discovered that, from some accident or mistake, any hive has not received an adequate allowance, the deficiency is best met by placing some barley-sugar over the feed-hole (under a bell-glass

* "It is frequently the case in winter that a number of bees may be found, apparently dead, about a hive, particularly after sudden disturbance. The greater part of these are merely paralysed on coming out into a lower temperature, and may be recovered by taking them to the fire. But this should be done with caution; for, if placed too near, the bees are not so likely permanently to recover as when the restoration is gradual. The best way is to put the bees into a large basin, spreading over it a piece of muslin to confine them till they are restored to the hive." Such occurrences are to be regarded as incidental only, for the torpid state is not a regular phase in the life of bees, as it is in that of wasps.

† "In two stocks which I had an opportunity of examining, at the end of February, 1838, after a very severe winter, I found cells filled with honey in a granulated state, and perfectly white. This was untouched by the bees, though they were distressed for food. Notwithstanding the unusual severity of the season, there was brood in various stages of progression."

or bottle or other close covering), or between the combs, or even through the flight-hole, the bees being given full access to it in its dry state. Directions for making this article will be found under "Spring Feeding"—that season (or strictly the latter part of winter) being the time in which it is more legitimately required. Liquid food, given at this time, would probably produce dysentery.

Substitutes for Pollen.—Upon the first revival from their mid-winter inactivity, it will be of the utmost importance that a good supply of pollen is ready to the bees' use, as it will tend greatly to forward the process of breeding, and therefore the entire progress of the hive. But, as mentioned on page 212, it is not advisable in the autumn to leave a very large stock of it in the hive, for any portion which is unconsumed by winter has a great tendency to spoil—that in the outer combs through mildew, and that in the inner through drying up. The requirements of the present season are therefore better met by a substitute to be supplied by the bee-keeper, and which accordingly—intelligibly enough, though not very correctly—has been given the name of "artificial pollen." Its use was first discovered, quite accidentally, by Dr. Dzierzon. Observing on an occasion that his bees were frequenting a neighbouring mill, he found on closer inspection that they were engaged in conveying from thence a quantity of rye meal. Deriving a hint from this discovery, he placed a trough of the meal in front of his apiary, and found it eagerly carried to the hives, the bees preferring it to old pollen;

this continued till the opening blossoms supplied the natural article. Some hives consumed as much as two pounds. Subsequent experimentalists at home have used the flour of wheat, or other grain, with success; Mr. Cheshire specially recommends pea-flour. The knowledge that the collection of pollen and the need of water by the bees are simultaneous, led observers a step further, and they made a rule of giving a supply of both these essentials at the same time. As this assistance has been afforded as early as January, it would seem necessary, in our climate, to place both articles in some accessible part within the hive. In the absence of any better provision, wet sponge or moss has been found to answer for the water; and old combs or wooden trays may serve, with cottage hives, as receptacles for the meal. With the movable frames, of course, the combs can be extracted and filled, for the meal will not be needed till it is both safe and salutary to open the hive.

At a meeting of the British Bee-Keepers' Association, in October, 1879, Mr. Cheshire made known a method of procedure adopted by himself, by which the meal appears to be supplied on a greatly improved plan. Recollecting that when bees stored pollen in their cells they covered it over with honey, he thought of giving them the two articles—that is to say, their substitutes, pea-flour and syrup—in a mixture already prepared. The meal was accordingly cast into the syrup, which, of course, it at once soaked up, and, when in a consistency that would just admit of being held upon a knife, it was

taken up and pressed with the blade into the cells of the extracted comb. In about an hour he found that the bees had removed the excess of syrup, and rammed down the paste, just as if it had been the naturally-gathered pollen; and in two days he was astonished to see that every particle of it had been consumed, though he reckoned that it must have been about four ounces. He remarks that by this means, which did not necessitate a single bee leaving the hive, he accomplished what would have taken hundreds of the insects many hours if the meal had been simply supplied them in trays placed before the hive.

This very simple procedure may therefore be recommended for general adoption during winter. But on the days when it is warm enough for the bees to fly abroad, and especially as the spring is approaching, the other course may answer every purpose, the meal being supplied in bulk; when the bees, as soon as they get to know its value—which some of them do not very readily at first—will take to it with the greatest eagerness, rolling in it till it colours them all over, and carrying it off in large quantities to their cells. But immediately that they can obtain the natural pollen, their relish for its substitute disappears.

It is amusing to note the assertions still made by some as to pollen being an unnecessary article to bees. They tell us of instances in which brood has been reared and comb constructed at times when it was practically impossible for pollen to be found. Perfectly true; but they are forgetting Dzierzon and

the depredations upon the rye-mill. As far as the letter of the dispute is concerned, their position is established: bees *can* do without pollen, the same as a man can do without mutton—by the simple process of substituting beef. It is not pollen as pollen that the insects must have, but they must have some sort of nitrogenous food; and pollen is the sort most assimilated to their nature, and which most readily falls in their ordinary way.

Cleaning.—As far as any disturbance of the bees would be involved, this must be deferred till they are again on the move—in March, or perhaps at the end of February. But the flight-holes should be inspected from time to time, to make sure that there is no accumulation of dead bees within, for these not only give great offence to survivors, but endanger the safety of the colony by preventing the passage of air. Whilst the bees are in activity they attend to this duty themselves, but in winter it must be performed for them. This is also the season in which *empty* hives should be renovated in readiness for spring requirements. All other work of the nature of preparation should likewise receive attention during this season of enforced comparative leisure.

As soon as the above-named period of cleansing has arrived, Mr. Cowan recommends a complete transfer of the family into another hive which has already undergone its renovation. The old one is then scalded and washed over inside and out, frames included, with the solution of salicylic acid, as directed under "Foul Brood," the combs also being sprayed with the same before they are inserted in the

fresh hive. The bees are fed on syrup containing the same ingredient—which keeps the syrup from candying, and serves also as an antidote against the above disease.

Melting of Combs.—This is one of the tasks that will be most conveniently carried on at this period, and there is then the additional advantage that there is no fear of the bees coming in to annoy the operator. Here, again, the editor will make free to quote from one of his own additions to "The Apiary," though, as will at once be seen, the passage therefrom is only re-written from the directions of others :-

"Comb for which there is no use as such should be melted down into cake wax. Brood comb which has undergone its five years or so of service will probably not repay the trouble, and should therefore be thrown away. But if in good condition it should be put into a clean saucepan with plenty of soft water, and gently boiled or simmered over a clear fire till it is melted, when the wax will rise to the top. It must then be run through a strainer (never mind a little water going with it) into a stoneware or earthen pan, the sides of which have been greased to prevent adhesion.* The refuse is then collected in a coarse bag and boiled again, a flat iron or other heavy weight being placed upon it to hold it down, and a plate or other false bottom beneath it to prevent its burning. By working this

* If wax of the finest quality is desired, the portion obtained at this stage in the operation must be kept by itself, and, after being covered well up, must be set in a spot so warm as only just to permit of an extremely gradual solidification.

about with a rod or ladle, a quantity more of wax will be brought out from it, and more still by applying to the bag a wet rolling-pin upon a board also wet; the additional wax thus obtained may be added to the other, and the whole boiled again with a very little clean water and over a slow fire. Skim off the dross as fast as it appears, and then pour the whole again into the greased pan, and, after letting it cool slowly, scrape off the settlings. The above is in the main Mr. Cheshire's method. Another is that of Mr. Payne, who would pour the original boil into a canvas bag of about a quart, which should be laid on an inclined board in a tub, with cold water in it below the reach of the bag; then, applying the roller, the wax is all expressed at one process, and may be collected on the water and boiled again as before. The operation must be carried on where the bees will not be able to get admittance, or the odour will bring them in great numbers.

"Virgin comb, being free from cocoons or other rubbish, will not require the squeezing process, but may simply be melted into the pan, gradually cooled, and melted again. If the cooling is artificially delayed, the wax will be all the clearer. If bleaching is desired, melt it again and pour it out so as to form thin streams or plates, and then lay these for a few days in the sun; take care, however, that they are not melted."

Dysentery.—The presence of this disease may be known by the dark-coloured evacuations, offensive smell in the hive, and frequent deaths. It often

attacks the strongest hives, if too much closed at the mouth, particularly at the latter part of winter or in early spring, the most critical time for bees; and no doubt it is attributable to unnaturally retained fæces in a damp impure atmosphere, with deficient covering and ventilation. It has been thought that the want of water predisposes the bees to dysentery, strange as this may seem by the side of the more certain fact that *too much* water, in the form of liquid food supplied too late in the year, is a frequent superinducing cause. As soon as it has appeared, no time should be lost in lifting the hive from its board, expelling the vitiated air, and scraping and washing away all impurity; repeating the same process, if requisite, on some fine subsequent day. But the board should be dried before the hive is replaced on it; or a fresh one may be at once substituted for it, with less loss of time and annoyance to the bees. Mr. Taylor speaks of having restored a stock to perfect health by the above measures, after a third of the inhabitants had fallen a sacrifice. Where combs are movable, such of them as contain unsealed honey should be taken away, and barley-sugar will be the proper kind of food. Disturbance of the hive is very apt to bring on this disease, as the instinct of the bees impels them, upon every alarm, to gorge themselves to inflation, whilst their unwillingness to void their fæces in the hive brings on this disorder when they are unable to venture out. Their abdomens become swollen in consequence, and even bursting, so that the entire appearance within the hive is pitiable in the extreme.

Chilled Brood.—This is a disaster almost sufficiently explained by its name, but which, till quite recently, was very generally set down as a milder form of the terrible plague described in the following section. In its main feature—the brood dying off and drying up in the cells—it certainly bears a striking resemblance thereto; yet even Schirach, in 1784, spoke correctly of it as "properly no disease at all"—it is an *accident*. Its usual inciting cause is a sudden fall of the temperature, at the close of winter or beginning of spring, causing the bees to crowd closer together in the centre of the hive, and thus leave the outer combs deserted, and the brood upon them to be chilled to death. The bees will sometimes proceed at once to remove and eject the perished brood of themselves; at other times they will let it remain, when it will turn to a dry crust at the bottom of the cells. It is desirable, however, that this should not be allowed to remain long, or the effluvium arising may produce the more serious disease. There is obviously nothing to be done for the chilled brood but to clear it away; but, with a view to prevention, the inhabited part of the hive should be restricted to dimensions sufficiently narrow to allow of a proper maintenance of warmth.

Von Berlepsch, who, like others, appears to include chilled brood among the forms of "the uncontagious foul brood," speaks of the latter as sometimes liable to be occasioned by the food of the bees, in which case his quotation, "not a disease," becomes obviously inapplicable. Consider-

able confusion must be looked for in authors in reference to this complaint and those which, for want of a clearer understanding of them, we are compelled as yet to set down, with more or less inaccuracy, as milder forms of the next. We believe, however, that there are still recognised an "uncontagious foul brood," as well as a "mild form of the contagious foul brood;" and a genuine example of the former, in its very mildest aspect, is presented in the case cited by the Baron from Spitzner, who, in 1781, set some thirty hives in a wood abounding with bilberries, and found, on bringing them home, that the combs, to a height of six inches, were coal-black, and all the larvæ dead; these, he adds, the bees removed, and, after a week, the cells were reoccupied with brood, which "throve splendidly." Obviously, a trifling matter like this is as different as light from darkness when compared with the real brood-plague, under whose name it is at present classed.

Foul Brood.—This formidable malady appears, like the Rinderpest, the potato blight, and some other epidemics, to have assumed almost its first existence in the course of the present generation. It is, however, probably alluded to by Bonner, in 1798, as "a disease which sometimes, though rarely, happens to bees;" but Aristotle's mention of "a disease accompanied by a disgusting smell," cited by Mr. Langstroth, may perhaps have had reference only to dysentery. At all events, Von Berlepsch tells us that in the famous bee country of Thuringia it was absolutely unknown until 1858, and that old Jacob

Schulze, of that district, who died in 1854, had never met with a single case of it during his long practice of fifty years. Our own author, moreover, passed his work through six editions, each supposed to be revised up to the latest state of knowledge, without so much as mentioning the name of foul brood.

During the past six or eight years the Germans —to whom we have still to look for all our larger advances in apiarian science—have been determinedly investigating the real nature and origin of this pest. To Dr. Preuss belongs the credit of showing that a certain thread-like fungus, to which he gave the name of *micrococcus*—so minute that a single cell would contain some thousands of billions —is invariably present in the infected larvæ; and, after him, Pastor (now Dr.) Schönfeld carried on further investigations, with the assistance of Drs. Cohn and Eidam, the former of whom detected, amongst the above corpuscles, a multitude of other thread-like growths, which he at once pronounced to be *bacteria*—forms of life till lately set down as infusoria, but now regarded as fungi, and which are known to be present in various epidemic diseases both of human beings and of cattle. When this was made public, scientific men at once turned to a remedy which was known to be efficacious in destroying these *bacteria* in other cases; and in a short time bee-keepers were rejoiced to learn that by the use of salicylic acid they were put in a position to cope with a plague before which they had hitherto bowed in utter hopelessness.

Having been thus tempted to place the most interesting facts at the head of our notice, we must now proceed to that description of the disease itself which ought more strictly to have stood first. This we propose to supply in the form of an analysis of Von Berlepsch's lengthened account of the symptoms and supposed inciting causes of the disease; for, though some of his remarks will at once strike our readers as out of date, the majority of them remain of value, and there is still sufficient obscurity attached to portions of the subject to warrant the reproduction of all that he has to say. Indeed, foul brood is still the *bête noire* of apiculturists, and nothing but the most scrupulous and persevering pains will suffice to save any portion of a colony, when once attacked, from remaining, throughout its existence, a propagator of miasma to every hive and apiary in the neighbourhood.

Let us just premise, for the sake of the beginner, that foul brood is a disease affecting the brood alone, but which is so terribly contagious that the bees in an infected hive will convey the *micrococcus* spores wherever they go, and thus renew the outbreak in any sound brood to which they may subsequently be conjoined. When we speak of the bees as being themselves diseased we therefore mean no more than that they are charged with the germs which will produce disease in the brood; and when again we talk of "saving the bees" we refer to the brimstone-pit to which, if not disinfected, they will require, sooner or later, to be doomed.

In the symptoms and nature of this malady there

have been three degrees observed. The following is a description of the first and most malignant of these—the genuine foul brood, or "brood pest." At first, some ten or twenty cells are observed to have their covers sunken in, some of them with a small round hole. Upon one of these being opened the larva is found of a brownish colour, and with its head downwards; it usually dies before turning into a nymph, and shortly after the sealing. It is rare, in this most serious form of the disease, to find foul larvæ still unsealed. The form of the grub soon ceases to be recognisable, and it melts away into a clayey, slimy material, which, in from ten to fourteen days, dries up into a nearly black crust on the lower side of the cell. The bees attempt to gnaw down the cells to the middle wall, but, as the disease advances, they let the mass of corruption alone; they fly forth but little, and devote their whole attention to expelling the foul stench by ventilating with their wings. Sometimes, upon a fine spring or autumn day (for this disease is peculiar to no one season, though we have here, for convenience, placed it along with others), they will forsake the hive in a swarm. If brownish or black grains or crumbs appear upon the floor-board, which, when rubbed, turn into a smeary stinking mass, it may be set down as certain that this form of foul brood is present. From a quarter to a half of the larvæ soon die, though, even in the worst cases, they some of them continue alive.

The second degree is a mere shadow of the first. The complaint is nothing like so rapid, nor yet so

severe, and sometimes disappears wholly of its own accord, as tho Baron has himself repeatedly observed; but care is requisite, or it may develop into the more malignant form.

The third degree is apparently slightly milder than even the second, but it is noticed on the authority of Dzierzon alone. In this case it is the uncovered larvæ chiefly that die, rarely the others. The material to which they turn is more like broth, and not so tough or clammy as in the malignant form; it dries to a crust at the bottom of the cells, and the bees, so long as they are strong enough, can remove it without difficulty. It is made manifest by the appearance of dark brown little scales upon the floor-board. A stock will hold out under it for two summers, and sometimes wholly recover of itself.

All these forms are set down as more or less contagious, and the following are noticed among the means of spreading the disease: feeding with honey from foul hives; miasma conveyed by the surrounding air; robbing; the hands of the bee-keeper as he passes from hive to hive without washing; the depositing of a stock where a foul hive had stood it may be a year before; and even (says Dzierzon) the settling of bees upon flowers where bees of an infected stock had settled before them.

The cause, says Von Berlepsch, we do not know, and all that we can do is to take the ground from under the feet of the disease by putting a stop to all breeding. The first degree, he adds, is absolutely incurable, and, *at most,* the bees may be saved

by putting them, for forty-eight hours, into an airy vessel, and then into a new dwelling, cutting away all their former comb. But even this the Baron never managed to accomplish; the bees, in every instance, catching the disease afresh, and having to be brimstoned at the last. So wrote Dzierzon: "Better make short work of it . . . and spend your money in buying sound stocks. Burn out the hives with straw [as a first disinfectant], then brimstone them, wash twice with strong solution of chloride of lime, and leave them to dry in the sun or air. After the second degree they can soon be used again, but, after the first, not for at least two years. Wash the stands repeatedly in the same way, and leave them empty a year." Happily this paragraph expresses a state of things which the bee-keeper is not compelled to realise any longer.

There follow, in Von Berlepsch's work, a series of speculations as to the origin of the disease, and some, at any rate, of these remain as forcible as at the first, for we are still confronted by the question, "What are the conditions that favour the development of the *bacteria* and the *micrococcus* spores?" The first supposed cause was that a very small fly (*Phora incrassata*) enters the hive and deposits its eggs, one apiece, in the brood-cells, making choice of such of them as are in an advanced stage, but still unsealed. The phora larva hatches inside the bee larva, and eats away its inside in ichneumon style. Now, this particular insect is known to deposit its eggs only in dead bodies; yet the Baron believes that some such parasite is the originator of

the malady in those cases in which only one or two stocks in an apiary are attacked, and when it seems clear that there can have existed no means of contagion. A second view attributes the origin to honey that has fermented and become acidified, as is especially the case, he says, with the American and Polish cask-honey. Though this honey may come from wholly uninfected stocks, its fermenting property seems to exert its effect sometimes upon the brood. Mr. Mahan, of Philadelphia, when in Cuba, frequently saw the combs of brood, pollen, and honey, together with the brimstoned bees, put under strong pressure, and the juice squeezed out and called honey! This "horrible sauce" would speedily ferment, and he knows many instances in which the supply of such honey to the bees has occasioned foul brood in America—though the disease is all but unknown in Cuba itself, for the Cubans know the danger, and most carefully guard such honey from the insects. Dzierzon had foul brood in 1848 through honey from Cuba, but the effect of other cask-honey is mostly similar. It seems to cause the disease indirectly, by begetting a bad smell, and it has always been six or eight weeks after its administration that foul brood has broken out.

A third view is that if from any cause bees which have died from the uncontagious form (or from chilled brood) are not removed from the hive, the smell arising from their bodies may beget the contagious form. A fourth view speaks of the possible effect of a poisonous dew with which blossoms are at times attacked; Dzierzon inclined to favour this supposi-

tion. Fifthly, is set down an idea somewhat resembling that which has been since pursued to the discovery of the cure—the existence of a thread-fungus in the chyle-stomach of some bees, which it is conjectured may prevent their digesting the pollen which they have to prepare for the larvæ. This the Baron would not accept at all; "for," says he, "healthy stocks often exhibit this fungus" (in itself, however, he tells us elsewhere it is believed contagious). The sixth and last view ascribes the disease to too great meddlesomeness on the part of the bee-keeper—incessant interference with the natural course of the insect life, and the repeated administration of noxious smoke. The fact of the disease having been all but unknown till the experimental processes of the present generation came into vogue,* must cause the reflective to ponder, as the Baron did, over this quotation: "The nearer bees are left in a wild state, the less does the disease show itself; and the movable combs and especially the Italianising mania, have brought it to its culmination. It is very likely to be brought on by too frequent removal of frames, too violent shaking of combs, the admittance of dazzling light or hot rays of the sun, or by strongly narcotic tobacco smoke." Very naïvely the Baron adds, "This is the view of my wife, who, without my knowledge, and not altogether to my particular gratification, communicated it to the *Bienen-Zeitung* in 1868." He winds up, however, by declaring that if we cannot deny that there is something in the idea, still

* So Mr. Neighbour writes in "The Apiary:" "Foul brood is not a very general complaint, and, as far as our observation extends, has been most fatal in large experimental apiaries."

there are so many other possible causes, that we are not called upon to decry the movable frames when in the hand of a sensible apiculturist.

To the above list of exciting influences we append the following from an excellent paper by "A Lanarkshire Bee-Keeper:" Foul brood, he says, may be brought on (1) by internal damp; (2) by immoderate feeding, which raises an undue heat in the hive, and, if supplied below or on the fountain principle, causes the bees to cluster around the openings to such degree as to choke ventilation; (3) neglect of ventilation to swarms in transit; (4) the use of old combs in which, though perfectly clean, a small quantity of fermenting honey is contained. Hence, in regard to the second danger, he recommends the vulcanite plate; and in regard to the fourth, the washing of all old combs in solution of carbolic acid (doubtless he would now substitute that of salicylic acid, mentioned further on). In this connection it may be added that liquid food liable to ferment should be boiled again before being supplied to the bees.

We return then to the investigations of Dr. Schönfeld, as to whom the information may be acceptable that he has long stood in the foremost rank of German bee masters, and that Von Berlepsch committed to him the writing of his own chapters upon the senses of bees, as being "beyond doubt the best-informed of apiculturists on these subjects." He now stands second to Dzierzon alone, like whom he has worthily been honoured with the recognition of merit conveyed in the title of Doctor.

We cannot, however, enter into the details of his

experiments, which occupy three long articles and a speech in the *Bienen-Zeitung* of 1874. The following summary must therefore suffice. His object was to prove to demonstration the truth of the theory of Dr. Preuss, that the *micrococcus* fungus in the foul larvæ and cells—not that in the stomach of bees—was the essential accompaniment of foul brood; and especially that the conveyance of these threads in the air was the means by which, when once engendered, the epidemic was propagated and spread. This theory having been assailed by Von Berlepsch, as well as by others of less note, the Pastor's experiments were so devised as to be absolutely incapable of refutation, and they showed with marvellous uniformity that the *micrococcus* spores were really wafted about as he had surmised (in a special degree they would be set afloat by the wings of the fanners), and that by catching them upon pieces of wool, he could produce foul brood at his will in any larvæ to which these were applied. He tried it first with the blow-fly, and afterwards with the insects more immediately concerned, and in both instances his efforts were crowned with the most striking demonstration that his reasoning was true.

A question naturally presents itself as to what is the relation between the *bacteria* and the *micrococci*, but this we are as yet hardly in a position to answer with certainty. The latter, however, appear to establish their presence first, and hence the conclusion of Schönfeld seems strongly supported, that they are germinating spores—the seeds, in fact, comparable to thistle-down—from which the *bacteria* fungi

subsequently develop. Though the latter, therefore, are the essential constituents of the disease, they appear to be powerless in spreading the contagion until sufficient of a dry crust has been formed to enable the *micrococcus* spores to be carried away by the air. Whether this conclusion will lead up to an explanation of the uncontagious foul brood, it is perhaps too soon to speculate. Schönfeld wrote thus, in January, 1874: "Though, certainly, as Dr. Preuss rightly remarked, no scientific distinction can be drawn between the mild and the malignant kinds of contagious foul brood, there is yet so much the more decided ground for separating the mild form of the uncontagious and the bad form of the contagious. The former shows itself as a dying off of the brood from a variety of causes, but it never becomes contagious so long as fungi do not make their appearance; the latter is a dying off of the brood in the form of a fouling, in consequence of accumulated fungus formations."

We come then to the method of using the salicylic acid, "the great antiseptic virtues of which," says Schönfeld, "consist in nothing else than in its capacity of killing as with a stroke of lightning the *bacteria* which are the originators of the foulness." As its name implies, it is obtained from the willow tree (*salix*); it is a crystal powder of a sweetish taste, and wholly free from danger if administered either over the bees or internally. A British apiculturist residing in Denmark, Mr. J. S. Wood, of Nyborg, published in the *British Bee Journal* of December, 1875, some useful particulars which we may

here present in summary. In place, however, of his recipe for the acid solution, we refer our readers to the more recent one of Mr. Cowan given a little further on.

On the first favourable day after winter, when the bees have been out, procure some unslacked lime, and moisten it just sufficiently to make it fall to powder; sow it plentifully all around the hive, so as to cover every spot for a distance in all directions of at least four to six feet; also upon the hive itself and its floor-board. Examine the hive as early as possible, and cut out the infected cells, or reject the combs entirely, if reserve combs are at hand. The pieces cut out must be dropped into a box or other vessel containing lime, the utmost care being taken to avoid leaving them to lie about. Each comb must then be disinfected by sponging with the solution, and injecting it into every cell by means of a spray-producer. If there is a spare hive, transfer the frames and bees thereto, first disinfecting any combs containing honey which may be in it (compare the caution above given by the "Lanarkshire Bee-Keeper"), and then begin feeding with the medicated syrup. The foul hive must then be safely closed, and removed for disinfection as below.

If there is no spare hive, all the wax, refuse, &c., must be carefully removed into the lime-box, and then every available part sponged as above, and the hive and floor-board wiped as dry as possible by repeated wringings of the sponge; the combs and bees are then replaced, and feeding commenced. If

the weather is such as might chill the brood upon exposure during the operation, some temporary receptacle must be provided to afford it a shelter.

For hives without frames the bees must be driven out as soon as the weather is warm enough ("about the time when gooseberry-trees come into leaf"); then the solution must be passed over the combs as completely as possible with the spray-producer. The bees are now returned, and left to swarm; when, after about twenty days, those in the old hive are transferred to another, the combs destroyed, and the hive, if worth the trouble, disinfected.

For the carrying out of this last operation, both with hives and apparatus, the following are the directions given: Thoroughly cleanse, and then place them in boiling water (if too large, set them over a boiler, and pour the water continually over them with a ladle); scrape, scrub with a brush, and rinse again with boiling water; set in the sun or wind to dry, and then disinfect by painting them with the solution, or dipping therein, as the case may be.

It will at once have been noticed that the directions with regard to skep hives involve leaving the bees and hive only half cured for a considerable period; and as *half cured* means *uncured*, one would think that by far the wiser plan would be to recur to the old stamping-out régime, instead of leaving the colony to be a source of even partial danger to all its neighbours. Indeed, so difficult is the problem in the best of cases, that Mr. Cheshire writes to us, "I *have succeeded* in curing it, but the process re-

quires more unremitting attention than most bee-keepers would be disposed to give."*

It is a highly desirable precaution to stop the production of brood in an infected stock; and for this end the queen must be removed. It is held by some that the royal person is proof against the *micrococcus* spores, and will not convey the contagion with her; consequently, it is usual to transfer her to any other hive which is either in a queenless condition, or ruled by a monarch inferior to herself. As to this supposed immunity, however, which reads more like superstition than science, the explanation is probably very simple: the spores float about freely in the hive and render the colony infected *as a whole;* yet they may have settled upon only one-third or one-tenth of the individual bees, and hence, by the law of chances, the queen would in a majority of instances escape.

Extended as have been our remarks on this subject already, we cannot abstain from appending some valuable directions by Mr. Cowan which were conveyed in a letter to Mr. Cheshire, and by him inserted in the number of the *Journal of Horticulture* specified in the note below. He writes as follows: "You know I had it in my apiary, and it was a source of great trouble to me, but I stamped it out with salicylic acid. My proceeding was to excise any very bad places, and when I found cells affected here and there I merely uncapped them and sprayed the

* Addressing those who *are* disposed to give this attention Mr. Cheshire adopts a more encouraging tone when he writes in the *Journal of Horticulture*, October 2 1879: "I assert its curability because I have again and again cured it."

combs with the solution of which I send you the recipe. I found generally in mild cases one application was sufficient, but in more severe ones two or three doses produced a complete cure. I found that if the cells were uncapped before they were punctured, and sprayed with the solution, injecting a larger quantity into the affected cell so as to eject the viscid mass, there was no fear of the disease appearing again. In this state the viscid fluid in the cells is of a light brown, and is not permeated with spores to such an extent as when it is allowed to remain until it becomes highly coloured and the covering much depressed. I doubt very much if in this stage it is very contagious. I have no doubt the acid acts on the spores and destroys their vitality. So far so good. Now, as regards the honey that is in the hive, and which is supposed to contain the spores (although I must say I have never been able to detect any by the microscope), how are we to ensure their being destroyed? Simply by uncapping it and feeding the bees on syrup containing the acid, which they will store with the uncapped honey; or uncap it and give it a good spraying with the acid solution. I have done both, but cannot say if it was really required; but as I think prevention is better than cure, and as it is not much trouble, there can be no harm done.

"All my hives are scalded, and so is everything that has had anything to do with the hive, and afterwards everything is washed over with the solution. I believe the germs of the disease are carried in the air, and we can never feel safe; *I therefore always*

put acid in all the food I prepare. I examined six of my hives, and all were healthy but one, and that I thought was also healthy. It was an early swarm. This year I had thrown off a swarm and a cast, and had given me six small one-pound sections nicely filled. I looked on the ten frames and found no queen and no brood. There was one cell covered but not punctured, but I at once recognised it as a foul-broody one. Now, the hive had not been queenless very long, as about ten days ago I saw the queen, and although she was not laying, there was a small quantity of brood hatching out, and all did hatch out except this one cell. It was uncapped and injected with the solution, and the other combs and bees sprayed with it. I have no doubt it will prevent its spreading in the future, as I shall not hesitate in using these combs in uniting if I require them.

"I have examined six hives to-day, fearing to find foul brood, but have not detected a single cell in any of the other hives. Now, how did this appear? It seems to me probable that it was brought there by some of the bees from outside, or a spore might have been lurking in some of the corners of the hive and had escaped the solution. This proves to me that it is impossible to tell when it may break out in an apiary; and as we know from experience that salicylic acid destroys the spores, I think it not only beneficial but important that a certain quantity of this acid should be in all the food given to the bees. Two years ago I tried feeding the bees on syrup containing a strong dose of acid, without spraying

the combs, and I found that the disease gave way to this treatment; but I find the other plan, that of uncapping and spraying, the most rapid. I do not mean to say, if a hive is neglected, so that all the brood is rotten, it can be cured; but if taken in time, as every apiarian would do, it has been and can be cured."

To this letter Mr. Cowan appends his recipes for the salicylic acid solution, as well as for the syrup medicated therewith, which, as above stated, constitutes the regular supply of his bees. This syrup, as modified respectively for spring and summer and for autumn and winter, will be found under the heads "Spring Feeding" and "Autumnal Feeding;" the *acid solution* which enters into its composition, and which serves also, when alone, for purposes of painting and spraying, and for all the processes of disinfection and prevention, is prepared as follows:—

Salicylic acid	1 oz.
Soda borax	1 oz.
Water	4 pints.

SPRING MANAGEMENT.

Those who commence an apiary by the purchase of established stock-hives, and who did not secure such in the autumn, can, with the opening of February, and for the five or six weeks ensuing, make a selection of those that have the characteristics of health and strength—a matter which may in general be very readily ascertained on a fine day by observing the quantity of farina carried into a hive. "The best time," says Payne, "to establish an apiary is from the middle of February to the middle of March. The stocks will have passed through the winter, and the removal is safe and easy. There are few commodities in which a person can be so easily deceived as in a hive of bees. I would therefore recommend the young apiarian to take the opinion of some experienced person before he makes his purchase. If the hive is not of the preceding year, its weight is no criterion of its value; for an old stock contains a large quantity of pollen." An examination of the combs, as to discoloration, will often be a useful criterion of age.

The selected stocks should be removed to their new quarters by hand, at dusk, as per directions given on page 172; they must then be no more disturbed. The caution on page 161 as to purchasing of a near neighbour must not be overlooked, and if such course is unavoidable, the hive should be closed for three days, taking care to give it sufficient ventilation. The bees of a new *swarm* just hived never think of

returning to the spot which they had themselves voluntarily deserted; but those that are brought away against their will from the home in which they were established, or which they had come to recognise even for a day, are certain to return thereto, if in the course of their new flight they come across their customary landmarks.

General Directions.—As soon as vegetation begins to appear, with genial weather, all obstructions to the free access to the hives must be removed; and by degrees extended space given at the mouth. The critical time for the bees is now approaching; for in February brood often rapidly increases, requiring greater attention to the preservation of a uniform warmth. The tops of the hives not already under cover should therefore be closed in, to prevent currents of cold air, which are often at this time fatal both to the eggs and larvæ, as may be seen by the ejectment of dead grubs. Even much later on in the season the recurrence of cold days will leave certain proofs of mischief; and at such times the mouths of the hives ought again to be contracted and screened, carefully retaining the outer coverings till all danger is past.

The bees will now, in fine weather, go forth in search of pollen, which they bring into the hive in large or apparently in useless quantity, so as sometimes to render it necessary afterwards to remove it, at a great expense of labour. "This," says Gelieu, "is the only point on which they can be accused of a want of that prudence and foresight, so admirable in every other respect." A

supply of pollen, together with water, are the first requirements of the spring, both essential to the brood; and the eagerness of the bees to seek them is a certain indication of health and strength in the hive. The supply of the substitute for pollen (page 246) must, however, be maintained as long as the bees continue to resort to it—which they will do until the opening blossoms afford them their natural provision. Stocks thus treated are greatly forwarded both in breeding and swarming. At page 162 a list is given of early flowering plants, which it is desirable to have in the immediate vicinity of the hives. At present the bees are weak, and unequal to a long flight; the weather, too, is on many days unfavourable for it.

An attentive observer will now readily distinguish the strong, healthy stocks; but now and then a family may be seen sluggish in its work, though, perhaps, not deficient in numbers. The cause may generally be traced to an unfruitful queen, to be got rid of as soon as the season is a little more advanced, when a successor can be reared in the way described under the head "Queen Bee." Or the same may happen if the queen has died before the bees have the means of establishing another, when an abandonment of the hive often ensues, though honey may still be plentiful in store. Prudence will at this time point out the expediency of surveying the state of the apiary as to repairs, painting, &c., to be carried out before the bees have fully entered upon a state of activity.

Spring Feeding.—It is well now to examine the

remaining stock of food, for much will shortly be required for the increasing numbers. If needed, some must be given, though in less quantity than in autumn; and it ought to be placed within the hive, either at the top or bottom; but the time is arrived when every precaution should be used to prevent the effects of chill to the brood by the creation of cold currents. It usually suffices to supply food about three times a week, but the feeding trough must be closely covered, to keep up the temperature, or the bees will not at first enter into it. When this is the case, some proprietors do not hesitate to invert a hive, and pour a cup of honey amongst the combs, upon which the bees will soon lick one another clean (if a frame hive, of course no inversion will be requisite). At this season it is well to give the food slightly warmed. Many persons recommend feeding even the strong hives, for it is certain that the bees are stimulated by the increased temperature to which this gives rise; and there can be no doubt of the importance of bringing the stocks forward as early as possible. But no feeding, unless from absolute necessity, should be resorted to till a certain degree of animation is visible in the dwelling, otherwise the bees are prematurely put in motion, and numbers perish, unable to reach home. Nor is it of less importance to observe that feeding is not discontinued too soon; for even after warm days there will be a return of ungenial weather, and a stock might perish where a very little additional food would have saved it. But some limit should be put to the quantity as the weather becomes fine and warm; for I have

known evil arise where the cells have been filled by the bees with sugared mixtures, at the time when the queen requires them for the accommodation of her eggs. We have already alluded to the advantages of a supply of water within, in the very early year, before the bees can go abroad.

Where honey of a quality not good enough for sale is at hand, it is of course preferable to anything else; and it is no worse for being made slightly liquid with water. In other cases various kinds of substitutes have been resorted to. Mr. Taylor advised good sound ale, sweetened with sugar and honey, and boiled for a minute or two (a pint of ale to a pound of sugar, and a quarter-pound of honey). But except in the above event, bee-keepers do not think of using honey at all now-a-days, the syrup described on page 205 being all that can be desired. As the season advances, it will, however, require to be made *thinner*, and Mr. Cowan supplies the following recipe as modified for *spring and summer* feeding (boiling for a few minutes as before):—

White lump sugar	10 lb.
Water	7 pints.
Vinegar	1 oz.
Salicylic acid solution ...	1 oz.
Salt	1 oz.

The kind of food we have been describing is that which is most commonly used for bees at this season. I have, however (says Mr. Taylor), turned my attention occasionally to the saving of trouble that arises where food can be given them in a concrete form, to

supersede some of the evils attending the administering of liquids at this season. In one of my feeding troughs I have sometimes put some large lumps of refined sugar, dipped previously in water, till pretty well saturated (loaf sugar in a dry state they cannot appropriate). Of the various concrete saccharine preparations, however, I have found none entirely combining the needful requisites except that in which the crystallising properties of the sugar had been altogether destroyed. It is well known that this change can be effected by certain methods of boiling. I believe I am correct in stating that the heat required to convert crystallisable into uncrystallisable sugar is from 320° to 360° of Fahrenheit. If, therefore, to two pounds of loaf sugar half a pint of water is added in a saucepan, it must be boiled up to a temperature not exceeding 360° of heat. This may be pretty well known when the syrup becomes brittle; ascertainable by suddenly cooling a little on a cold substance, or plate, when it begins to assume a pale yellow colour. The longer it is exposed to heat, up to this point, the more perfect is the change produced; but about twenty minutes' boiling is usually sufficient. If, instead of water alone, a fifth to a fourth part of vinegar is mixed with it, the process is expedited; and when thus made, the bees appear to give it a preference.* The whole must be poured out gradually upon a cold dish, or a slab of stone, marble, or slate, previously rubbed with a very little fine oil, or other unctuous matter, to prevent

* It will be well to add the salicylic acid solution, in the same proportion to the sugar as directed for the syrup above.

adhesion. In a few minutes it is sufficiently stiffened to allow of being cut, with a pair of scissors, into such conveniently-formed pieces as are best adapted for insertion into the hive at its mouth. To those who do not object to the trouble of preparing this kind of bee-food themselves, the cost may be estimated at that of the sugar, as there does not appear to arise any loss in weight. It will be seen that this preparation differs but little from the common confection familiarly known as *barley-sugar*. The bees, as lambent insects, have no difficulty, from the deliquescent properties of this concrete, in appropriating it speedily; and in the use of a large quantity there is a freedom from the usual degree of disturbance observable when syrup is administered. It may be given at any time of the day; and an impoverished family might frequently be saved by inserting a few sticks of barley-sugar within a hive, when any other mode of feeding was impracticable. In fact it would appear that no other artificial food is so acceptable to the bees; and much of it doubtless returns to the proprietor, intermixed with natural honey. By the process we have described, common sugar has now been converted into a substance much resembling in its properties the saccharine matter of certain fruits, as grapes, &c., known as uncrystallisable sugar; probably nearly identical with the honey collected by the bees from the nectaries of flowering plants. After exposure to the action of a moist atmosphere, the concrete soon assumes a dissolved form; and thenceforth it so remains, as I have

proved by keeping it unaltered in any way for several years; in short, it becomes a substance very much resembling honey.

One apparent discrepancy may have been observed in our directions as to feeding, and in part we must confess that it is more than an apparent one, and arises from the loose way in which our author has divided his four seasons. Mr. Taylor's spring, during which the bees must receive barley-sugar in preference to liquid food, is simply the latter half of winter; while Mr. Cowan's recipe for syrup of *increased* liquidity during "spring and summer," does not apply until the legitimate springtime, when the insects are again in full flight but possessed of an insufficiency of stores.

Enemies and Robbers.—The enemies of bees, already pointed out at page 186, should now have the attention of the proprietor; and more especially robber bees, for these are sometimes troublesome at this season, particularly where the hives are placed not sufficiently apart. On this subject we would refer to what has been said at page 203. Let a vigilant look-out be given for queen wasps, now becoming common, and destroy them in any way possible; remembering that each of these is the parent of a future family. When the wasps are seen to alight, the use of a garden syringe and water is often effectual in disabling them from flying, when they are easily killed.

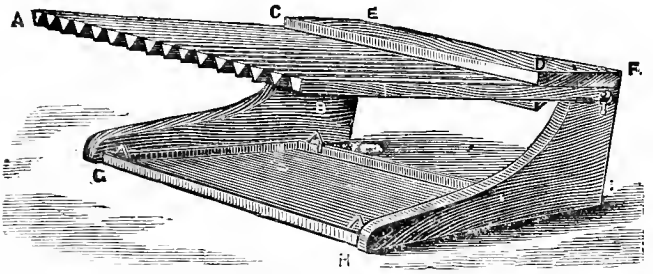
Cleaning or changing Floor-boards.—All who have been accustomed to the care of bees must have perceived the saving of labour to them, in the early

spring, in the cleaning of their floor-boards, by scraping away all filth, removing dead bees, refuse wax, &c., and thoroughly drying them. In many cases the best and quickest plan is to change the board, and particularly when it shows signs of decay, which always leads to mischief.

Comb-pruning.—In conjunction with an examination of the floor-boards, opportunity can be taken of observing the state of the hives as respects their combs. Where these are seen to be old, mouldy, mildewed, or infected by moths, they should be cut away; as also when they have become filled with a mass of stale pollen and useless honey; at the same time taking care not to disturb any brood there may be in them. It is well to remove, every year, a portion of the older comb in a hive, with the view to effecting an entire transfer in the course of five years. Hives sometimes contain too large a proportion of drone comb, which can now be removed with advantage. Some persons use a little smoke, but at this season it must be resorted to sparingly, as the bees are weak. They will speedily fill up the vacancies thus made, and a stock in this way partially renewed may be continued in health for its successive generations of several years, provided the hive itself is in good state.

Transferring Bees with Combs.—This process, which certainly is a formidable one to any but an experienced hand, is now very frequently carried out with a view to shifting a stock from a skep to a frame hive. The bees must first be expelled from the skep, either by drumming or by smoking. If

any sticks have been inserted they must be at once withdrawn in the most careful manner devisable. If the hive is of no value it can be cut in half; but if otherwise, the honey-knives mentioned on page 202 must be used to detach the combs. When this is done the Cheshire transferring board (or rack) is of most invaluable assistance for the rest of the work, in place of a common table or other board, which must else be made to do duty. This board consists of a sloping stand of parallel bars or teeth on which to lay the combs as cut from the hive. The figure shows its construction. A frame is laid



upon the teeth, and within it the portions of comb are pieced together—preserving their original position on account of the slight *tilt* of the cells—tapes being bound round the whole, where needful. The operator stands in front (A B), the bottom bar rests at C D, there is a zinc tray (G H) to catch droppings, and as soon as a frame is completed it is brought into a perpendicular posture by turning the entire apparatus (tray excepted) upon its hind end (E F), the angles of which are so adjusted that the

rackwork will then be exactly erect. The frame can now be safely removed. If the comb does not fill it, empty comb may be used to fill the vacancy, or an additional bar, as a false bottom, may be inserted. There are hooks at E and F which allow of the rackwork being withdrawn when out of use, and slidden into the tray so as to be held by the triangular eyes in its corners. This well-devised piece of apparatus is kept by Mr. Lee in two qualities, which sell respectively at 10*s*. 6*d*. and 5*s*.; but the latter, he says, with a little adaptation, will prove as useful as that at the higher price.

As the operation above described is one which it is not very easy to run away from when once begun, there is a value in Mr. Neighbour's advice to "have in readiness all the necessary appliances. These consist of a large knife for cutting the hive, a good-sized table [or the Cheshire board] on which to lay the brood-combs, a basin of water for washing off honey which may besmear the hands, tape or string to fasten the combs in their frames, a pair of honey-cutters for cutting out the combs, jars to hold the honey that runs out, and a feather for brushing off any bees that may remain."

Super-hives.—As the season continues to open, young bees will become numerous, timidly peeping out of the hive, and distinguishable by the lightness of their colour. With genial weather, wealth also rapidly accumulates; and the strong odour of the hive, and increased activity of its inmates, attest the growing prosperity of the family. Attention is now requisite to these symptoms of a rising temperature,

and, consequently, to the crowding of the hive. If the glass windows become sensibly warm, attended with clustering at the mouth, increased building room should at once be given, as above detailed at pp. 51 and 188, or under the head of "Nadirs;" for a fertile queen will require a large proportion of the stock-hive for the purpose of depositing eggs. Should a few cold nights ensue, the supers must be kept covered; and more especially glasses, which the bees will desert unless a warm temperature is fully preserved in them.

I much doubt the likelihood of our preventing the swarming of bees when the extra storing room is delayed till royal cells have become tenanted, or, perhaps, only formed.* Mischief has also frequently arisen where the bees have all at once had a large additional space given them of too cold a temperature, or been afforded undue or ill-timed ventilation, as in using Nutt's hives was often the case. The same cause has sometimes operated to prevent progress of any kind; and in a collateral hive thus managed, I witnessed the fact that, during five or six successive seasons there was no more breeding or storing than barely sufficed to keep the unhappy family in existence, the proprietor deriving no benefit whatever.

Temperature and Weather.—With the advance of the season, and a more abundant efflorescence, the buzz of the hive becomes louder and more general,

* In frame hives such cells can be cut comp'etely away, and in so doing the surrounding cells will some of them have to be sacrificed, as the greatest precaution is advisable against leaving the jelly for the bees to devour.

and particularly when the family are all assembled at night. And now the exertions of the bees are called into action for the purpose of promoting ventilation and expelling the vitiated air by means of a rapid and continuous vibration of their wings. This collective fanning gives rise to a considerable sound, but we are assured by Von Berlepsch that that usually known as humming is caused by the *breathing* of the bees. Sometimes the heat of the hive impels the inhabitants to seek a cooler temperature by clustering on the outside. At such times it is often well to aid in moderating the warmth by slightly raising up the bottom edge of the supers with a few strips of wood or lead. At page 185 we have given some general recommendations relative to the shading of exposed hives, as also on the subject of water.

In most localities, the best part of the honey season will now be approaching; and much consequently depends on the state of the weather. In particular, a prevalence of dry easterly winds, acting on vegetation, causes the suspension of almost all operations; so that the main honey-storing time is often limited to three or four weeks in the season, or frequently even less, in our uncertain climate. The secretion of honey is remarkably promoted by an electric state of the atmosphere. Huber says truly of the bees, "I have remarked that the collection by these creatures is never more abundant, nor their operations in wax more active, than when the wind is from the south, the air moist and warm, and a storm approaching." A certain

commencement of the latter is to be looked for when the bees are seen rapidly hurrying home in crowds to the hive. Payne may be cited in this connection. "I am not aware," he observes, "that bees have ever been placed in the list of those animals which are said to foretell the changes of weather, as many of the feathered and insect tribes are; but in my opinion they stand foremost of the weather-wise. A nice observer, by looking at them in the early morning during the working season, will very soon be able to form an opinion as to what the day will be, and that almost to a certainty; for they will sometimes appear sluggish and inactive, although the morning is very bright, and showing every appearance for a fine day; but the sun soon becomes clouded, and rain follows. And, again, the morning may be dull and cloudy, and sometimes rain may be falling; still the bees will be observed going out in considerable numbers; and as sure as this is seen the day becomes bright and fair."

"Thou wert out betimes, thou busy, busy bee!
When abroad I took my early way;
Before the cow from her resting-place
Had risen up, and left her trace
On the meadow, with dew so grey,
I saw thee, thou busy, busy bee!

"Thou wert alive, thou busy, busy bee!
When the crowd in their sleep were dead;
Thou wert abroad in the freshest hour,
When the sweetest odour comes from the flower;
Man will not learn to leave his lifeless bed,
And be wise, and copy thee, thou busy, busy bee!

"Thou wert working late, thou busy, busy bee!
After the fall of the cistus flower;
I heard thee last as I saw thee first,
When the primrose blossom was ready to burst;
In the coolness of the evening hour,
I heard thee, thou busy, busy bee!"

SOUTHEY.

Swarming.—The month of May, in fine seasons, usually brings with it the period of the greatest interest to the proprietor as regards the swarming stocks of bees; on which subject we would refer to page 46. Drones now begin to make their appearance, darting out of the hive in the middle of warm days, though occasionally in strong stocks they may be seen in April; in which event early swarming may be looked for. The usual limits during which swarming takes place vary in different localities; but in general they are comprised within the months of May and June, though in extraordinary circumstances a swarm may issue somewhat earlier, or a little later than this. When it is expected, the hive should be watched from ten in the morning till two or three o'clock, after which time a *first* swarm rarely sets forth.* In particular, the bees ought not to be left for five minutes if a hot sun intervene between showers; for a greater predisposition to swarming then exists than in dry weather. It seldom, however, takes place with an east or north wind.

It is not always easy to distinguish the appearances that precede a first (or *prime*) swarm, and

* *After*-swarms may be later; Von Berlepsch draws the distinction that the one usually starts in a morning and the other in an afternoon.

experienced apiculturists are sometimes deceived. But observation of the interior of the hive shows the usual time (accidents as to weather not interfering) to be that in which the larvæ of the royal cells are about to be transformed into nymphs, and therein sealed up; viz., six or eight days before the young queens are matured; for it is to be remembered that on the occasion of a first swarm it is always the *old* queen that accompanies it. The issue of a swarm is frequently to be expected when the bees have remained for some time previously in a state of seeming inertness, followed by an unusual commotion among the drones; and more especially if these make their appearance in the morning, hanging out with a cluster of bees; conjointly with a disinclination among the workers to foraging abroad. If, in addition, the honey previously stored in a super is observed to disappear suddenly, swarming may be anticipated, as the bees are then loading themselves before leaving home. But mere clustering at the mouth of the hive is not invariably the precursor of a swarm (though it will be a very strong indication if the cluster is formed in the morning and continues steadily enlarging in spite of the sun); for the bees frequently continue to congregate in unmeaning idleness on the outside, even though honey may be abundant. "In this case," says Dr. Bevan, "the cluster may be swept into an empty hive towards dusk, and carried to a short distance from the apiary, when they will gradually return, and generally join the family." This, however, is often only a temporary expedient;

and the prolonged continuance of a period of inaction may be occasioned by the want of a princess to succeed the queen. Or it may be that the hive contains an unfruitful queen, and a weak population with insufficient warmth, when little of store is collected and often no drone eggs are produced, these being always the preliminary of royal cells. A continuation of unfavourable weather, moreover, notwithstanding the sealing up of the queen-cells, will often prevent any issue of a swarm; for if the start should not have been made till within two days of the hatching of the first princess, she and all her sisters are destroyed; though new royal cells are set on unless the idea of swarming is abandoned for the season. Neither as to swarming will the state of the thermometer be an invariable guide. I have rarely seen it reach as high as 95° within a stock-hive, but I have observed the issue of swarms at a temperature four or five degrees below this; and in one instance it occurred when the thermometer ranged but little above 80°.*

It is common to imagine that a swarm consists exclusively of the young bees of the season; but this is almost the reverse of the fact. The strictly young bees, as we know, are the *nurse* bees, and nothing short of absolute proof would convince us that these leave the hive before their natural time

* Some naturalists, and amongst them Huber, have imagined a much higher degree of heat at the time of swarming; but in this there must be some error, for I have proved that the combs collapse and fall at a temperature a little above 100°. I am almost ashamed to say that this experiment cost me the destruction of a fine stock-hive.

of flying, merely for the sake of going with a swarm. Von Berlepsch, on the contrary, says that a swarm is made up of all the *adult* bees which are at home at the time of starting, and sometimes this is equivalent to all the adults in the stock—none but nurse bees being found to be left. Several hundreds of drones accompany the emigrants. It is not always an easy matter to estimate the strength of a swarm. The bulk is not entirely a criterion, as the temperature of the weather causes the bees to cluster together more or less closely. A pint will usually contain about 2000, while 5600 are estimated to weigh a pound; but this latter varies, for on swarming they are always provident enough to load themselves more or less with honey before their departure, so that the pound would be fully made up by 4000. A good swarm, however, ought to weigh from three to five pounds, and if it attains to six it will, according to a series of careful experiments by Von Berlepsch, be more productive than any other weight either smaller or larger. As to a *settled* colony, he says, there seems no upper limit—"the more bees the better."

Returning of Swarms.—Cases sometimes occur in which it is thought desirable to compel the return of a swarm to the stock-hive. On this subject we will use the words of Payne. "The process," says he, "is very simple, and I have always found it succeed. As soon as the swarm is settled in the hive, turn it bottom upwards, and, if the queen bee does not make her appearance in a few seconds, dash the bees out upon a cloth, or a gravel walk,

and with a wine-glass she may be easily captured. Upon this the bees will return to their parent hive. The queen may also very easily be taken during the departure of a swarm; for she appears to leave the hive reluctantly, and may be seen running backwards and forwards upon the alighting-board before she takes wing." I have sometimes found it advantageous, instead of a cloth, to place on the ground four or five large sheets of paper. On these the bees have been spread, and the sheets carried in opposite directions, thus enabling a better search to be made for the queen; and especially is this the case with a second swarm, for then there are frequently three or four. Where there is no queen, the bees will soon be in confusion and fly to their original home; but in the reverse case she may be discovered by their congregating in one particular part. Nor is there any danger in this proceeding; for the bees, being gorged with honey, are not often disposed to attack, provided the precaution of not breathing upon them is observed. Moreover, any such operation is best carried on in the shade, as a hot sun makes the bees less tractable at all times. Occasionally it might happen that, on the issuing of a swarm, the queen, from inability to fly, falls to the ground, when the bees will return to the hive, and such return is often attended with advantage.

In judging of the desirableness of compelling the return of a first swarm, we must be guided by circumstances. Should it be a large issue, expediency would dictate the hiving it at once as a new colony; for the queen may reasonably be

supposed to be a vigorous one, and a compulsory returning of the bees to the parent hive (the result of destroying her) would occasion a loss of valuable time; a young queen not yet being in a state to commence laying eggs. On the other hand, a poor swarm might denote an unfruitful queen, to be got rid of in the way we have just pointed out. The bees would reissue under a young sovereign, after the usual interval, with a large accession of numbers, the produce of the brood matured in the mean time; and this might have the further good effect of preventing an after-swarm, which it is always desirable to do.

It has already been said that on the occasion of a first swarm the *old* queen invariably issues with it. It is also a fact that she leaves no actual successor, but that an interregnum usually occurs of six or eight days—the royal larva being left short of maturity by this period, unless bad weather has interposed to delay the issuing of the swarm, in which event this interval may be much shortened; it is also subject to extension under certain contingencies of weather. The first princess that is subsequently liberated from her cell becomes the future mistress of the hive, unless she leaves it with an after-issue; for the law of primogeniture has been observed to be strictly followed. It is therefore evident that no regal disagreement can occur except in the cases of after-swarms, when a queen returning to the stock-hive might chance to find a rival, and would have to contest her way to the supremacy.

After-swarms.—It is not an unusual thing to hear a boast of a number of swarms from a stock-hive; but nothing is proved by this beyond the fact that a thriving community has been weakened (if not destroyed) by too much subdivision. The proprietor therefore must not imagine that his care is ended with the return of a swarm to the parent hive. Though one queen has been removed, several successors are usually at hand, and swarming may occur again and again, so long as more than one is left. The hive must be watched more especially from the eighth to about the twelfth day from the departure of a first swarm, after which another rarely issues; the probability, or rather the certainty, then being, that the first-liberated young queen has succeeded in destroying the others—an event always to be desired. But the symptoms which precede a second issue, if less numerous, are more unequivocal than those in the previous case. The young princesses are now arriving at maturity, and two or more may be ready to come forth at the same time; impatiently awaiting the time when, by the migration of their eldest sister, it will become safe for themselves to leave their prisons. In this state of confinement they are objects of great solicitude, and are supplied with food through a small orifice in their cocoon. On issuing forth they are already fully able to fly. At this precise period, a singular and plaintive call or croak, proceeding from the young queens, may be heard, often at a distance of several feet from the hive, and more particularly in the evening. These notes are of two

kinds, according as the princesses emit them from without or within their cells. For want of a more distinctive term, these sounds have obtained the name of *piping*. To Huber we are largely indebted for the knowledge we possess as regards this peculiarity in the natural history of the bee; and his observations have since received abundant confirmation—perhaps from no apiculturist more satisfactorily than from Mr. Golding. "The first note of piping heard," says the latter, "is low and plaintive, and is uttered by the princess already *at liberty*, and I have frequently seen her emit it. She traverses the hive, stopping upon or near the royal cells which still contain brood, and emits her *long* plaintive note. This, when the other young queens are sufficiently forward (generally in about two days), is answered by them from *within* their cells, in a quick, *short*, hoarse note. After these last have been heard for about two days, the swarm may be expected to come off." "These sounds, therefore," in the words of Keys, "convey to the apiarian one certain warning, that when heard, he may be assured the first or prime swarm has escaped." But universal as this rule has been considered, it has not been entirely without exception; for in a stock-hive of Dr. Bevan's, in the remarkable season of 1852, swarming had been so long prevented by bad weather, that a young queen became liberated, and on her escaping into a super, piping was the consequence for two days before the issue of a *prime* swarm.

After-swarms are frequently accompanied by more

than one young queen; often by three or four, or even more than that, and always in the virgin state. "Indeed," observes Mr. Golding, "it would appear that all which are ready to quit their cells (one only, be it remembered, being at liberty in the hive until the moment of swarming) go off with the swarm; leaving the more forward of the younger princesses to come off with subsequent swarms, or 'fight out' their title to the sovereignty of the parent stock at home."

A third and even a fourth issue sometimes takes place (a *fifth* is recorded by Mr. Langstroth), the intervening periods successively becoming shorter, and more piping being heard. As all the royal cells must have been tenanted before the old queen departed from the hive, it follows that a term of about sixteen days comprises the limit during which, under ordinary circumstances, swarming can occur; and thenceforth the queen bee is mute for the year. Moreover, the worker brood originally left in the hive will now, or in a few days, be matured, leaving the combs less occupied, probably in any way, than at any other period of the year, until the young reigning queen is in a condition again to stock them with eggs. This state of the hive is therefore considered by some as the most favourable for examination and excision of old combs, and for other operations usually attended to in the spring.

I have known piping after a second swarm has departed, where no third issue has followed. The second swarm, however, in this instance, was restored to the stock-hive on the same evening,

together with one queen. This is often the best time for making a reunion of after-swarms; for I have usually found that all the queens except one are ejected on the same day: that one, being stronger than those still in the parent hive, is able to destroy them on her return to it. If a cloth is spread on a table, placed in front of the old hive at dusk, the bees of the swarm can be jerked out upon it, and guided to its mouth. In two hours after the reunion just mentioned, piping from a queen at liberty was heard. The next day two young queens were ejected—one of them torn from its cell, not having attained its full growth; while from the other the sting was protruding, evidently the result of a recent combat. Piping was again heard on the following morning; and soon after, another princess, doubtless the last, was cast out of the hive, and this I took away still alive—making five in all since the issue of the first swarm. We may observe that when swarming has taken place as often as the colony intend, the original utilitarian principle no longer impels the bees to guard the royal cells; the reigning princess being then permitted to tear them open and destroy any prospective rival. Exceptional cases, however, occur, and not altogether rarely, in which two or even more queens will settle down to reign in the same hive.

It is not clear by what instinct bees are guided as respects after-swarms, or rather as to the construction of royal cells; for, as has been shown, these abound much more in some hives than in

others. The repeated issues occasioned by the presence of supernumerary young queens, although there has previously been a rapid development of brood, not only leaves a hive comparatively depopulated, but the succession of interregnums is mischievous as operating to suspend, not breeding alone, but almost entirely the gathering of honey. A different kind of instinct appears to direct the bees from what is observable at the time of the original issue; for the young queens will depart in weather that would be thought unfavourable for the issuing of an *old* one. This seems as if it might possibly be owing to the fact that both the reigning queen and the bulk of her colony are young and inexperienced; and in strict keeping herewith we find that there is evidently less of foresight as regards the future place of abode. Where so much of prudence and seeming intelligence are discernible in all the proceedings of these wonderful insects, it is hardly to be expected that mere chance should direct on so important an occasion as the change of residence; a first swarm therefore issues scouts or pioneers to seek out a place of abode, although when it suddenly finds itself in a comfortable dwelling, by the act of hiving, it is rarely inclined to relinquish it. A hive containing a few combs, placed in the season near an apiary, is almost certain to receive a colony, which will sometimes fly to it at once, without any previous clustering.* The

* In the garden of a friend stood an untenanted hive, in which were a few empty combs. Some straggling strange bees were observed hovering about and in it for several successive days; and, at my sug-

instances are numerous of prime swarms proceeding a considerable distance to a new domicile, carefully inspected and cleaned beforehand. I was an eye-witness to an example of this, where the bees, taking a dislike to the hive in which they had been housed, soon after quitted it; and, mounting high in the air, flew in a direct line to the roof of a church nearly a mile distant. But an after-swarm appears to make little or nothing of preparation, and has been known, in seeming perplexity, to commence comb-building in the bush on which it had alighted.

Uniting of Swarms.—It has been shown that it is easy to compel the return of a swarm of bees to the parent hive; but their remaining there depends much upon accidental circumstances. We have seen that several young queens are often only waiting their time and opportunity to leave their cells and depart from the hive; and till all these are in some way or other disposed of, there can be no progress made in the family. Under such circumstances, many persons think it best to hive all swarms in the usual way, and to strengthen the later ones by joining two or three of them together; for, separately, these are rarely of any value. In cases where more than one after-swarm, or subdivided swarm, comes out on the same day, each can often with little difficulty be shaken into

gestion, the hive was left undisturbed. On the day following the giving of this advice, a fine swarm of bees suddenly made its appearance, undoubtedly from a distance, and entered the hive. In this instance, a few hundreds, or perhaps dozens, of pioneers alone could have been in the secret as to the locality of the chosen domicile to which they so sagaciously conducted their queen and a community of perhaps 20,000 bees.

the same hive, one upon the other; or the branches on which such swarms cluster may be cut off and brought to one hive. Otherwise, a generally certain method of union may be resorted to after working hours (not after dark, unless by means of a Stewarton nadir, for otherwise the bees in numbers will fly, and not seeing their way, will settle upon the operator). On either of the first few days within which a swarm has been established, another may be added to it. On the same evening of the issue, in front of the one to which the second swarm is to be joined, place a table, over which spread a cloth. By a sudden and smart stroke the bees may be displaced from the second hive, and will fall on the table in a lump. Take the first-hived colony and place it over them, raising the hive a little at the bottom, when the bees below will ascend and join it, forming one family. In moving this hive, caution is needed, for otherwise the combs, being at present new and brittle, are apt to fall down. It is seldom that any quarrel takes place if the business is done properly; but some persons think that a little smoke previously blown into both the hives, has a tendency to prevent fighting. Early the next morning move the hive back to its former position, when one of the queens will have been deposed. In thus uniting swarms, the doubled colony should always occupy the first hive. As a general rule, it may be remarked that the mode the most likely to succeed is that in which the bees are suddenly blended together, without space or opportunity for individual recognition or fighting, bee against bee;

but it must be done when the first hive contains but a few combs.

In this place it may be noticed, that in an apiary where a weak and sluggish old stock is now observed, opportunity can be taken to add to its numbers by uniting to it an after-swarm in the mode just pointed out; though some persons would prefer puffing a little smoke to both parties. If either queen be removed, the strangers will usually be well received, and this accession of numbers is almost certain to lead to a vastly increased activity and industry.

Like most other operations on bees, the mode of uniting swarms admits of variety, according to choice and circumstance; and some apiculturists prefer driving in the way for which general directions have been given at page 229; a plan that may be resorted to almost at any time. Another mode of junction can be effected by the aid of a sheet of perforated zinc inserted between the two hives about to be united—which will then require to be placed the one upon the other. As already remarked, there is little reason to doubt that the members of each colony of bees are distinguishable amongst themselves by a certain peculiarity of odour, and if this is assimilated to that of another colony, the proceeding appears to have the effect of preventing mutual dissension. When the construction, therefore, of the hives admits of their being brought into juxtaposition, the perforated zinc allows a free circulation of scent between them, without permitting actual contact of the bees. After leaving

matters in this position for two or three days, I have usually found, on withdrawing the zinc divider, that no disturbance has ensued.

Swarms upon the wing have an affinity for each other and will unite of their own accord upon recognition. Mr. Langstroth utilised this proclivity by stringing dead bees together upon a bush selected as being convenient for the hiving of a swarm. A piece of dark cloth, or anything resembling a cluster, may be found to answer equally well.

Prevention of After-swarms.—Where the construction of the hive admits of it, no doubt the repetition of swarming may be prevented by depriving it of the royal cells. Under the head "Frame Hives" we have alluded to the facilities given for objects like this; and if the purpose is to restore the first swarm to the stock, it may be carried out immediately on the issuing of the swarm, when but a small portion of the bees will be remaining at home. Let the crown-board be removed and the frames extracted as directed on page 192. Cut out the queen-cells as you proceed, replacing the frames. A quarter of an hour will suffice for the operation. In the meanwhile, the swarm may be hived in the usual way, and afterwards permanently returned; for the queen has now no prospective rival to involve her tarriance at home in the necessity of fighting for her life. Or again, as Mr. Golding says, "after the first swarm is gone off, subsequent ones may be prevented in this way: so soon as the long note of piping has been heard, cut away at the royal cells. The young

princess, *already at liberty*, will then remain queen of the stock."

Maiden Swarms.—Under peculiar circumstances of early season and situation, a prime swarm will occasionally send forth another, the original queen again going with it. This will be termed a *maiden* swarm; it is rarely, however, of much value. Such issue from the swarm, says Dr. Bevan, "usually occurs between the twenty-eighth and thirtieth day of its establishment. The only indication of the approach of such an issue, besides those already enumerated, is the worker combs, with which first swarms generally store their hives, becoming edged with drone-cells." Indeed, an indispensable condition necessary to a maiden swarm is a queen that has commenced the laying of drone eggs; and this rarely happens in the case of a young one, unless she is an Italian.

General Directions on Swarming.—An absurd custom, says Mr. Taylor, is very general of beating a metal pan, or some such sonorous thing, on the occasion of bee-swarming; this is called *tanging* the bees. The practice, doubtless, originated in the precaution formerly observed of ringing a bell, or giving some signal of the flight of bees, with a view to an identification of the property in case of its straying to a distance. By degrees the idea became prevalent that the bees themselves were the parties interested in the hubbub. So writes our author, and such is now the orthodox explanation of tanging; but as this work has been passing through the press we have happened to meet with a passage in the Fasti

of Ovid which attributes to it a far more venerable antiquity. "They report," says the poet, "that honey was discovered by Bacchus. He was proceeding from the sandy Hebrus, accompanied by the Satyrs, and they were now come to Rhodope and the flowery Pangæum. The cymbal-bearing hands of the attendants gave forth a clang. Behold, impelled by the sound, unknown winged creatures swarm together, and the sounds which the brasses produce, the bees pursue. Bacchus collects them as they flit about, and shuts them up in a hollow tree, and he has his reward in the discovery of honey."* There follows a rich passage about Silenus getting stung by thousands of insects on his bald head, through too eagerly seeking after the new treasure, and his being then directed by Bacchus to smear his face with clay—a remedy for stinging which we have not included among our specifics. But to return to the tanging. It is clear, not from this mythological story alone, but from what immediately follows in our own author, that this clamour *does* affect the bees, but affects them in the wrong way; so we leave the question for further decision to those better versed in antiquarian lore. Mr. Taylor continues that as regards the bees the proceeding is worse than useless, as it frequently prevents their settling so soon as they would do if

* This passage occurs at the 736th line of the Third Book of the Fasti. The translation, slightly varied, is taken from one prepared by the present editor for the Key to Dr. Smith's Principia Latina, Part III. Another sentence occurring in the same work may here be cited as illustrating an ancient mode of depriving hives: "What [joy] when the swarms are flying from the *yew-boughs* placed beneath them, that the combs may be withdrawn and relieve the bending osiers!" (Rem. Amor. 185).

left quietly to themselves. The drenching or anointing of a hive, intended for a swarm, with any kind of material, is another common practice much better avoided. A dry clean hive is preferable; only, if of straw, cutting off the loose ends.

As respects the precise mode of housing a swarm, no directions will meet all cases. After rushing in great apparent excitement from the family domicile, the bees form a cloud in the air, wheeling about in a thousand directions, and exhibiting a scene of the greatest animation; then, for the purpose of assembling together, they alight and cluster round the queen that has accompanied them, usually on a bush or branch of a low tree. The hive must now be put close under the swarm, into which it is easily shaken; or, according to circumstances, swept with a light brush, which is all the better if made of very fine shavings; but care should be taken not to crush any bees. The success of the operation depends upon the inclusion of the queen, when the new family will soon collect with her, within the hive, on placing this in its proper position, a little raised on one side, and shaded in some way from the sun. In the event of a swarm settling in an awkward position for hiving, it may require to be either smoked or drummed therefrom — the hive being held over it, or a loose branch fastened by some means to tempt its acceptance.

On the occasion of swarming, bees are seldom much inclined to use their stings, unless irritated by wind; if any stinging does take place, it will

probably be from the bees of another hive—these being very likely to turn malicious if they see their master making a fuss. The hiving ought not to be delayed, especially with a hot sun, or the bees would soon again take wing, perhaps for a long flight, and be hopelessly lost. To induce them to settle, a handful or two of sand or mould may be thrown among them, or a garden syringe applied; or again, the flashing of rays from a mirror is strongly recommended. A somewhat larger hive may be selected for a full-sized early swarm than for a later one. In case a swarm returns to the parent hive, which sometimes happens, let the latter be watched, for it will soon reissue, and perhaps on the same day. Occasionally a swarm will divide and settle in two parts, which, if near together, can be shaken into one hive. Otherwise a junction may be made in the evening, in the way pointed out at page 297. An observance of the advice of Gelieu and others is to be recommended, not to allow the swarm to remain till the evening where it had been hived, as is customary, but to place it at once, as soon as settled, or within about a quarter of an hour, on the spot (if at hand) it is destined to occupy. In sultry weather raise the hive a little to admit air, especially if the swarm is a large one. When first hived, it is curious to observe the caution with which bees mark the site of their new position, making circuits in the air, wider and wider, till they clearly understand the locality. Having done this, they are much perplexed at any subsequent removal of their dwelling; nor do they

ever, under ordinary circumstances, re-enter the original parent hive.

We may say a word as to a practice of some proprietors, with a view of giving additional strength to a recent swarm: the stock-hive from whence the issue took place is moved to a little distance, and immediately that the swarm is settled in its new hive, the latter is placed on the site which the other had just left. The outlying bees, on returning home, will of course fly to the original spot, joining and strengthening the new family. The old one must necessarily be weakened in the same proportion, but it will soon be recruited by the maturation of the brood which it is sure to contain. Sometimes this shifting of the stock-hive has been allowed to be permanent; whilst in other instances it has been found more expedient to limit it to the two or three hours immediately following the swarming. The hives should, under the latter supposition, be then made to change places, and no bees would be lost, as one or the other of the two positions would be sought by them.

It may be well to refer the reader to what has been said at page 174, relative to the occasional necessity that might exist for feeding a newly-hived family of bees.

We know how largely swarming is influenced by the condition of the hive as to crowding or roominess; but it is erroneous to conclude therefrom that the inclination to swarm can be wholly disposed of by affording continually increased space. The increase ordained by nature could by no other means take place.

"Without it," writes Mr. William Raitt in the *Journal of Horticulture* (Feb. 12, 1880), "the race would in a few years become extinct. Many colonies would perish annually from starvation, disease, or the death of a queen at a season when she could not be replaced. To guard against such disaster, the desire for swarming has been implanted. Young queens are reared. The old one leads off a colony; in a few days the first hatched princess follows with a second.....and thus our one stock is multiplied to three or four." The practical remarks that follow are equally worth our reprinting:—

"It is not uncommon for bees to swarm out and leave the hive tenantless. This generally happens in spring, and is sometimes a result of approaching starvation. More generally, however, it is caused by the sudden arrival of warm sunshine after a period of cold. Glad of the opportunity of getting an airing, the bees become quite excited; the queen catches the excitement and also sallies forth, and, not marking her location, she is as likely to alight upon some other hive; and, the bees following her, the old stock is forsaken. There may be both honey and brood left behind. Such cases rarely happen except with weak colonies. Again, a false alarm frequently causes colonies with virgin queens to swarm out. The princess goes forth to seek the drone, and we have frequently seen a swarm issue with her. When such happens with an old stock that has already thrown all its normal swarms, there is seldom much harm done. The virgin queen marks her location and returns. Sometimes the swarm returns immediately,

but more frequently it clusters on a bush. When it is discovered that the queen is not with them, the bees return within half an hour or so. Certain stocks will repeat the delusion day after day, but as there will generally be sealed brood and lots of newly hatched bees left at home, and as the queen issues without any notice of swarming, but with every precaution for her safe return, there will seldom be any bad result. The case is quite different with colonies that are themselves swarms of the season. Having little or no comb built, and no brood to require attention, if they come out at all with the queen on her making flight they generally come *en masse*. The queen may return, but, finding an empty hive, she flies off to join the vagrants. Very often in such cases they all go to parts unknown. It is a safe rule for bee-keepers to provide every swarm with a comb of brood in all stages the very hour it is hived.

"It is well also that bee-keepers should bear in mind that the clustering of swarms on trees and bushes is not exactly a natural instinct, but a habit largely due to domestication. I suspect the natural instinct is to go directly to a hollow tree or other cavity previously selected and prepared. In most cases the clustering is merely temporary, or until scouts select the new abode. No time should therefore be lost in securing the swarm and supplying it with a comb of brood as above directed. The scouts may return and endeavour to create anew the emigration fury, but in such a case they will seldom succeed. I have, however, seen a swarm that must have hung on a gooseberry bush for three weeks. It had three combs from six to twelve

inches long, with sealed brood and honey. This anomaly happened, too, within a few hundred yards of a mansion, the roof of which was yearly a favourite resort of swarms."

Some allusion will perhaps be looked for to the old-established custom of clipping the wings of the queen, with a view to the prevention of swarming. But bee-keepers who once come to understand and act upon the system of procuring swarms artificially at their own will and time, will find no occasion to resort to this device, which, as we have pronounced it in "The Apiary," is surely "a clumsy proceeding at the best," and may even lead to the total loss of the royal mother through her attempting to issue forth, and then falling to the ground.

Transference of Swarms.—Many of the elaborate frame hives now in favour are unadapted or impossible for use in the common process of hiving a swarm, and consequently a skep is employed in the first place, and a transfer must be made therefrom to the permanent hive. The skep with its swarm may be temporarily deposited on the ground, well screened from the sun, and propped up with stones or sticks. A sheet may then be spread upon the ground in the most even spot that can be selected, and the frame hive, similarly propped up, will occupy a position near to and within one of the edges. The floor-board must be either removed or arranged to form an inclined plane up from the sheet into the hive. Mr. Cheshire's plan is to place a piece of boarding, some three feet square (page 170), upon the hive stand—not centrally, but with

the hive set down upon it over the stand, and a full half of the board projecting over the front edge; then, with his own hive, the front block beneath the floor-board can be removed, and the board will at once let down so as to form the inclined plane required (of course if the hive is combined with the stand the swarming-board will have to be supported upon another stand in front). Small blocks about an inch and a quarter in thickness (thicker if the floor-board is used), and placed one at each front corner of the hive, will give the desired admittance to the bees. Then, when all is ready—between sunset and dusk is recommended by Mr. Neighbour —the skep is raised and the swarm smartly ejected in the immediate front of the permanent hive, and when all the insects are driven out, the former should at once be taken out of their way to avoid the chance of its diverting their thoughts from their proper home. If there is any hesitation on their part towards making their way into the latter, they may be gently swept or scooped up to its mouth, or else sprinkled, smoked, or driven with a feather dipped in diluted carbolic acid.

A method adopted by Mr. Woodbury appears much simpler than the above, but is only to be commended to experienced manipulators. He would merely remove the crown-board and eject the bees from the skep immediately on to the tops of the frames, through which they would, after more or less awkwardness, disappear, and the board could be then replaced. But, as Mr. Cheshire said to us in noticing this plan, "the bees *boil over* in a manner to utterly nonplus beginners."

Artificial Swarming.—This practice, which is one of the chief features of modern bee-keeping, is thus alluded to by our author in his last edition: "Many apiculturists have practised the making of what have been termed artificial swarms of bees; in other words, have compelled them to leave the parent hive sooner than they would have done in their own natural way. What is more common than to see a large bunch of bees hanging in idleness, often for weeks, on the outside of a stock-hive, at the best part of the season? Is it not a great gain if we can contrive in some way to set this unprofitable community to work, in a new home? The advantages of early swarms have been already pointed out, and in our uncertain climate the risk is often great, either of losing them altogether, or of their coming too late for the principal season of blossoming. Such considerations have led to the compulsory system, which may, in one form or another, often be successfully resorted to by the practised hand, but otherwise it is scarcely to be wondered at that failure sometimes ensues."

Since the date when this was written the system has immensely developed itself, and the general adoption of frame hives has brought in many very material conveniences of which we previously were not possessed. In fact where there is not the advantage of movable combs there is, generally speaking, but one course by which to procure an artificial swarm—that of *driving*. The general directions for this process have been already given

(page 229), and we need add little here beyond the quotation from Dr. Dunbar which Mr. Taylor has placed ready to our hand. We should, however, premise that the doctor's confidence as to the queen being one of the first of the ascending bees is not shared by all, and the directions *usually* given involve the tiresome searching among the driven cluster to make sure that the monarch is in the desired hive (if she cannot be found, both hives can be set upon stands till the bees' behaviour shows which of them possesses her, and if this should be the old one, the process must be repeated). "We carried," says Dr. Dunbar, "the full hive into a dark place, turned it up, fixed it in the frame of a chair from which the bottom had been removed, placed an empty hive over it, mouth to mouth, and partially drove it. As soon as we perceived that about half of the bees had ascended into the empty hive (knowing that in these cases the queen is generally amongst the foremost), we immediately replaced the old hive on its former station, and removed the new one, now containing the queen, to a little distance. As the former had plenty of eggs and brood, they were at no loss to procure another queen; whilst the other, having a queen, proceeded to work in all respects as a natural swarm." We would merely vary these directions by advising that if the old hive is to be given the advantage of the old stand, it will be better to drum out three-quarters instead of a half of its population. To avoid annoyance, and loss of the foraging bees as they continue to return homewards during the

process of the preceding operation, it is well to set an empty hive (or it may have a few combs) on the site just before occupied by the parent stock. The bees will be in no very placid mood, and this piece of deception has a tendency to divert their attention temporarily, till the re-establishment of their old house restores them to their proper quarters. They will then be transferred as described in the previous section; and the same will be done with the driven swarm if it is not now in its permanent hive.

Some operators so far depart from the mode of proceeding we have described as to prefer placing the newly driven swarm, possessing the queen, on the old site. In such case the original stock-hive is removed to a little distance, and the entrance door stopped up, but the bottom edge sufficiently raised to admit a sufficiency of air only, with but little of light or sun. The bees thus confined are left undisturbed during two days, and will probably have spent their time in founding a prospective new monarchy. They may then be safely again trusted abroad, for in their anxiety about the requirements of the provisional government, they will no more trouble their old companions. Another variation of plan, recommended by some, is, instead of shutting up either portion of the bees, immediately to convey those driven into the new hive to a distance of not less than a mile, leaving the original position for the old one.*

* I may here not inappropriately call attention to a subject touched upon by Mr. Golding. His remarks are borne out by my own observation; and I believe it would be for mutual benefit were bee-keepers, resident a few miles apart, occasionally to exchange swarms in the

Mr. Neighbour tells us in "The Apiary" that he once obtained a swarm from a cottage hive by a much simpler method, in virtue of his having accidentally caught the queen in a super—a rare piece of good fortune for the purpose in hand, but, as he would doubtless maintain if it happened at the present date, the result of a neglect of proper precaution in giving her majesty access to such a position. Promptly closing the glass with a slide, he substituted an empty hive between it and the stand, and to this the bees on the wing of course returned, and had to make the best of their lot by building new combs, to which when ready the queen was allowed to betake herself (having been detained in the super with a few bees during the interval); while the full hive was removed to another stand and a new queen called into being by the starting of royal cells or the hatching of a princess already contained in one.

The above may be alluded to as a transition case which points us to the advantage possessed by frame hives. The purpose which a rare accident secured for once with a skep can with certainty be accomplished at any time where the combs one by

season. His views are conveyed in a passage in the "Shilling Bee-Book:" "Though I can give no satisfactory reasons for the fact, yet it certainly is one, that bees brought from a distance very generally thrive better than families long domiciled on the spot. I am borne out in this opinion by the concurrent testimony of my apiarian friends. Whether they ply more vigorously on finding themselves in a strange situation, or what can be the reason, I leave others to guess at." An American author observes on this subject. "I am strongly persuaded that the decay of many stocks may be attributed to the fact that the bees have become enfeebled by *close breeding*. The cultivator should guard against this evil by occasionally changing his stocks."

one can be extracted and the royal person readily made a prisoner. But this is very far from the only, or indeed the chief, advantage of movable frames, especially if all in an apiary are made of the same size. For we can then transfer along with her majesty the frame that she is on, and one or two more frames if we please from the same hive; and can next add thereto other frames from other hives —one, two, or three apiece as each is able to spare them—and then, by either setting the newly-furnished hive on the stand of one of the old ones, or else by obtaining a swarm from a distance, we can make sure of having bees enough to maintain the warmth needful for the brood. This is a mode of starting a new colony on the strongest scale; but it will at once be observed that if only the one comb upon which the queen was found was supplied, the colony would still be in a better position by that one comb than was the cottage hive in Mr. Neighbour's case; and yet the latter, he tells us, prospered.

In transferring hives to different stands in the way here pointed out, there is no danger of the entire loss of the bees, for whether these fly to their old or their new location they are equally sure of being among their own friends—a totally different thing from the promiscuous transfers sometimes recommended as measures for equalising colonies, for here, unless during a rich honey-season, a battle may be the result, or at least an encasement of the queen. The stock that is removed is, however, certain to lose a large portion of its population, and if this loss is

greater than is thought desirable, it may be remedied by means of *another* advantage of frame hives, for the frames of the over-thriving new colony can be extracted one by one and the young nurse bees shaken from them on to the alighting-board of the one which requires strengthening—the day of course being a warm one upon which there is no fear of chilling the brood. If this cannot be managed, the hives may again change places for a day or two; or driving can be adopted.

In searching in frame hives for the queen it is advisable to commence at the centre frames, for the chances are greatest that she will be upon one of these. Similarly, the frame upon which she is found should be placed in the centre of the new hive. As to the hive from which she was taken, the direction on page 110, to make all additions of empty frames in this same part, will apply to cases of artificial swarming, and to all such removals made during the working season, as it is observed that the occurrence of a gap always gives the bees a spur to increased exertions. But if the transfer should happen from any cause to be made at another time of the year, the frames in the hive should then be closed together, and the space curtailed by the usual shifting of a dummy.

For bee-keepers who desire swarms for their own sake the above directions supply all that is essential; but we doubt not that all who wish to go thoroughly into this branch of apiculture will procure Mr. Langstroth's invaluable work "The Honey Bee," in the tenth chapter of which they will find a variety of different courses of procedure which would

simply confuse the beginner if we made room to describe them all in these pages. In our section upon "The Swarming and Depriving Systems" we strongly recommended the practice of obtaining single swarms from the contributory populations of several distinct stocks; and the instructions above given for taking one or more frames from each of a number of hives will supply the practical method by which this principle is most readily carried out. It is open to the practitioner in that case to take the queen from one hive, and a single frame, or rather two frames, from each of as many more as he may choose—thus making up strong new colonies, but yet leaving the old ones comparatively undiminished. The new hive (or hives) should take the place of the very strongest of the old ones—it may be well for some of these to have been left with their full complement of combs, that they may contribute their adult population instead—for between the solicitude attendant upon a change of quarters and the fact that nearly all in the new colony are nurse bees, there will be not the smallest fear of the lives of those from another stock being sacrificed when they come unwittingly to bring the needed additions to its inhabitants.

Artificial swarming should be carried out just in time to stop the bees from natural swarming—that is to say, as soon as the state of the weather and the evidence of crowding in the hive have given signs of a need for increased storing room. The best time, as given in "The Apiary," is ten in the morning upon a fine summer's day.

There is one process adapted to the intermediate scale of swarming, as to which, though the same end could be secured by the one just alluded to, the practical particulars may be valued by some, and the editor will therefore convey them in one more quotation from his own additions to Mr. Neighbour's work:—

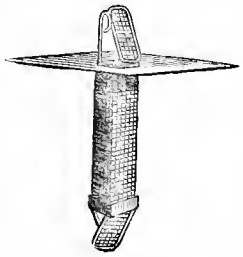
"There is sometimes a doubt whether a hive is strong enough to yield a swarm, though apparently overstocked. In such cases there is an excellent plan, devised by Mr. Langstroth and strongly approved by Mr. Cheshire, for obtaining a single swarm out of two hives. On a suitable morning, when large numbers are upon the wing, drum a strong stock till every bee has left it. Place the forced swarm on the old stand: this of course consists of bees in an unfurnished hive, while the old hive has lost *all* its bees, but retains its brood. Remove this hive to the stand of another strong stock, the hive of which goes to a third spot with the bees inside it at the time. Those of this last which were upon the wing will enter and remain with the first hive and raise a new queen; while sufficient will be transferred with the second stock-hive to protect its brood also. Thus the first stock gives no bees to the swarm, but the whole of its brood; the second gives the larger half of its bees. If frame hives are the ones used, the shaking process [of page 219] may be substituted for drumming; but as it may not be possible to shake off every bee without damaging the combs, a goose wing should be employed to brush off the more tenacious of the occupants."

We may append the following excellent precautions as to artificial swarming, which are condensed from Mr. Cheshire's "Practical Bee-Keeping":—

1. There must either be drones or sealed drone brood in the hive before a swarm is attempted (otherwise a queen already fertilised must be supplied to the swarm).
2. Honey must be abundant, or the bee-keeper must be prepared to feed constantly.
3. A swarm without a fertile queen must be supplied with ready-formed combs, as it will make only drone-comb itself.
4. An artificial swarm must either occupy the old stand, or be sent to a distance of not less than a mile or two (not a universal rule, see pp. 311, 312).
5. If left without either a queen or brood, such swarm will disperse among the neighbouring hives.
6. The best stocks should always be selected to swarm from.
7. The mouths of stocks swarmed from should be partially closed to preserve from chill and against robbers.
8. Stocks left accidentally too bare of bees should be fed with very thin syrup, and if necessary confined (merely opening the flight-hole for a short fly late in the afternoon, and closing it again after dark).

Supplying new Queens.—This operation is often closely connected with those of the previous section, but is perhaps of more common adoption at the present

day with a view to Italianising a stock. One method of carrying out this object has been detailed in the earlier part of this work under the heading "The Italian or Ligurian Bee;" but, as there notified, there are simpler courses ready to hand than the one quoted from Mrs. Tupper. With regard, however, to the single point now under notice—that of introducing a new queen to a colony—the directions there given cover nearly all that is necessary. The old queen, where there is one, is first removed, and then the new one is encaged either in a home-made queen-cage like Mrs. Tupper's on page 37, or in one such as Messrs. Neighbour's figured on page 148, or again in one like that shown in the illustration annexed, which is known as the Raynor cage, from its designer, the Rev. G. Raynor, who improved it from one brought out by the "Renfrewshire Bee-Keeper." It consists of a square tube of perforated zinc just large enough to fit between the combs, and which is provided with a door both above and below, and surmounted by a metal flange which enables it to be suspended from the bars of the frames or through a feed-hole. Mr. Raynor's own plan is to imprison the *old* queen first for some six hours, and then by opening the upper door to give her egress from the hive, and substitute her successor without so much as removing the cage from its position; then when the new monarch has been thus detained for twenty-four hours—or to be on the safe side it may



be better to say forty-eight—the lower door is pushed open by means of the wire which may be seen projecting at the top, and she is let out to take her chances of reception. If there are young bees in the hive, they may usually be relied upon to supply her with food through the sides of the cage; but if this is not the case, the bee-keeper must himself attend to her, or else prefer the other form of cage, which gives immediate access to the honey-cells. Mr. Raynor usually effected the liberation of the queen after dark, but others prefer a time when they can watch the behaviour of the bees, which very soon shows unmistakably whether they are resolved to receive her or are bent upon regicidal purposes. If they enclose her in a knot, this should at once be seized upon and dropped into a bowl of lukewarm water, when, if the queen is not already slain, she must again be imprisoned for a day or two. If royal cells have been made, they must be promptly excised, or their presence will materially interfere with the new queen's reception.

Cases sometimes occur in which an old queen may have to be encaged in her own hive. Thus we find Mr. Cheshire advising that when, with a view to the stoppage of robbing (page 204), two hives are transposed, the queens in both of these should be in this way protected from the danger noted above on page 314.

AUTHOR'S CONCLUSION.

In the foregoing pages I have given an outline of my own experience in the general management of bees, freely availing myself of such further information, derived from the most trustworthy sources, as seemed most likely to interest and instruct the reader. My aim, however, has been restricted primarily to matters of a *practical* bearing, passing over the obsolete speculations of bygone periods, and relying on the superior intelligence of a later day. Those who wish to enter more fully into the natural history and physiology of the bee may consult a variety of works, at the head of which it is usual to place that of Huber; followed by the later comprehensive and highly satisfactory one, "The Honey Bee," of the late Dr. Bevan; both publications to which we have often had occasion to refer.* That portion of the subject relating to the structure and arrangement of their combs and cells is treated of at considerable length by Lord Brougham, in his "Dissertations on Subjects of Science connected with Natural Theology." Perhaps the very accurate observations and elaborate mathematical

* Much more recent information will be derived from Samuelson's "Honey Bee," which, however, is exclusively confined to the natural history of the insect, and does not touch apiculture. If the editor may be pardoned the vanity, he would also refer to the third edition of Neighbour's "Apiary," the chapter in which upon "Anatomy and Physiology" he himself most laboriously revised by means of the best authorities, finally deciding disputed matters by a personal consultation with the late Mr. Frederic Smith—whose loss to science has occurred while this edition was passing through the press.

demonstrations of the noble author have left little more to be desired in the particular department to which he devoted the energies of his powerful mind. With his summary of the progress of apiarian knowledge, we may not inappropriately close the "BEE-KEEPER'S MANUAL."

"The attention," says Lord Brougham,* "which has been paid at various times to the structure and habits of the bee is one of the most remarkable circumstances in the history of science. The ancients studied it with unusual minuteness, although, being, generally speaking, indifferent observers of fact, they made but little progress in discovering the singular economy of this insect. Of the observations of Aristomachus, who spent sixty years, it is said, in studying the subject, we know nothing; nor of those which were made by Philissus,† who passed his life in the woods for the purpose of examining this insect's habits; but Pliny informs us that both of them wrote works upon it. Aristotle's three chapters on bees and wasps‡ contain little more than the ordinary observations, mixed up with an unusual portion of vulgar and even gross errors. How much he attended to the subject is, however, manifest from the extent of the first of these chapters, which is of great length. Some mathematical writers, particularly Pappus, studied the form of the cells, and established one or two of the fundamental propositions respecting the economy of labour and wax resulting from the plan of the structure. The

* Vol. i. pp. 333-36.

† Called also Philiscus.

‡ Hist. An. lib. ix. capp. 40, 41, 42.

application of modern naturalists to the enquiry is to be dated from the beginning of the eighteenth century, when Maraldi examined it with his accustomed care; and Réaumur afterwards, as we have seen, carried his investigations much farther. The interest of the subject seemed to increase with the progress made in their enquiries; and about the year 1765 a society was formed at Little Bautzen in Upper Lusatia, whose sole object was the study of bees. It was formed under the patronage of the Elector of Saxony. The celebrated Schirach was one of its original members; and soon after its establishment he made his famous discovery of the power which the bees have to supply the loss of their queen, by forming a large cell out of three common ones, and feeding the grub of a worker upon royal jelly; a discovery so startling to naturalists, that Bonnet, in 1769, earnestly urged the society not to lower its credit by countenancing such a wild error, which he regarded as repugnant to all we know of the habits of insects; admitting, however, that he should not be so incredulous of any observations tending to prove the propagation of the race of the queen bee without any co-operation of a male,* a notion since shown by Huber to be wholly chimerical. In 1771 a second institution, with the same limited object, was founded at Lauter, under the Elector Palatine's patronage, and of this Riem, scarcely less known in this branch of science than Schirach, was a member.

"The greatest progress, however, was afterwards

* Œuvres, x. 100, 104.

made by Huber, whose discoveries, especially of the queen bee's mode of impregnation, the slaughter of the drones or males, and the mode of working, have justly gained him a very high place among naturalists. Nor are his discoveries of the secretion of wax from saccharine matter, the nature of propolis, and the preparation of wax for building, to be reckoned less important. To these truths the way had been led by John Hunter, whose vigorous and original genius never was directed to the cultivation of any subject without reaping a harvest of discovery."

In conclusion, whatever may be the degree of ignorance or doubt in which on certain points respecting the honey-bee we are still involved (and these are probably not often practically important), there are few but may receive instruction and example from these wonderful little creatures, in the duties of persevering industry, prudence, economy, and peaceful subordination; whilst all may be taught, by their perfect organisation and faultless adaptation of means to an end, a lesson of humility; and, finally, by the contemplation of their beautiful works, to "look through Nature up to NATURE'S GOD."

APPENDICES.

A.

Brief Notes.

1. *Age at which the Queen flies.*—On page 29 of our text we have set down the usual date of this event as "the first fine day *after* she is two days old;" but we think it better here to point out that there exists much discrepancy between the results of different experiments upon this point. Mr. Cheshire informs us that he has pursued a series of most careful investigations, and his conclusion therefrom has been entirely in accordance with "the French experiments," and has brought out the *seventh* day as the one in question. Referring to Von Berlepsch, we find his words are, "The queen begins her flights on or about the third day after she has left the cell; at least, among all the queens whose age was known to me, I never in the course of my long practice met with one that flew *earlier*, though I am not prepared to deny that it may so happen upon occasion." Thus he has evidently not so much as an idea of any one denying that it takes place *so early*. Can it be that there are climatic influences at work which bring the insects to sexual maturity earlier in one country than another? Had it been India instead of Germany, we should think at once of a human analogy, and accept such an idea with little hesitation. The commencement of laying is set down by the above authority at from two to three days (probably sixty to seventy hours) after impregnation.

2. *A new View of the Italians.*—Under the heading "Black

versus Ligurian Bees," the *Journal of Horticulture* for February 12, 1880, reprints from the *Banffshire Journal* the following article signed "Robert Gordon," which is worthy of the most careful consideration from those interested in the subject :—

"Having studied closely the habits of bees for a long time, and having kept and experimented with them successfully for the last eight years, it may not be out of place to offer a few observations on the Ligurians.

"A hive of Ligurians and a hive of blacks, from their very natures, cannot be placed within a few yards from each other on equal terms, and the reason is obvious to every intelligent observer, whether bee-keeper or not. All Ligurian fanciers claim for them that they work in wet or dry earlier and later than do the blacks. Now any one can see that as soon as there is honey in the flower, so soon will the black bee go for it, and so long as there is honey so long will the black remain gathering it. Since the Ligurian can no more make honey than the black, and since it finds honey after the blacks have failed, it must obtain it from some other source than the flowers. Ligurian bee-keepers tell me—and I see no reason to doubt the statement—that the Ligurian thrives amazingly for a time where plenty of black bees are kept, and that nearly in the same proportion to the number of black hives within reach, so will be the honey-producing power of the Ligurian. I have often seen them coming out of the black hives, and certainly they were not helping the blacks, because in nearly exact proportion as they increased in weight the blacks decreased; and this transfer of the honey is not always accompanied with fighting, the Ligurians having what all successful pilferers generally have—viz., the knack of introducing themselves unchallenged anywhere if what is wanted is to be had.

"It is now a good while since first these persistent marauders were imported, and from their swarming propensities (I should have said that their breeding powers are said to be immense), and the number of swarms and queens sent annually over the country, one wonders how there can be such a thing as a pure black. Doubtless there would not by this time were it not for the Ligurians' liability to disease. Every now and then I read

in the newspapers that such a one has imported a Ligurian swarm or queen. After a while I read that the Ligurian is shooting far ahead of the blacks; again a short time and I read that the Ligurians have got foul brood. After a time I hear that the Ligurians are dead, after having infected a whole district with this abominable disease. Pure blacks are very rarely troubled with this or any other disease."

3. *Foreign Varieties.*—From a letter of "A Country Doctor," published in the *British Bee Journal*, of March, 1876, we make the following brief addition to our descriptions on pp. 43—46: "The Hungarian bee is described as black, and more industrious than the native [brown] bee. The Dalmatian is raven black, with a wasp-shaped body; very hardy and industrious, and remarkably gentle when unirritated. In reference to the tendency of bees to sting, Herr Cori [who is the writer's authority] seems to show, from the various sorts he has cultivated, that the higher the merits of the bees generally, the less inclination is there to irascibility; but when once excited they sting more viciously. The Herzegovinian bee is very similar to the Dalmatian, not however quite so black or so wasp-like. The first ring of the body when carefully observed has a slight yellowish appearance, which comes out very plainly when the body is kept in spirits. They are said to be as gentle as the Dalmatian, still more industrious, and the queens still more prolific." The Grecian bees, which we have simply named in the text, are partially bronze and rust coloured.

4. *Anomalies.*—Under this heading we will include a few of the more or less exceptional appearances and incidents in bee life, of an altogether miscellaneous character.

(*a*) Drones born of an Unfertile Mother.—We are assured by Von Berlepsch that whether drones are descended from a fertile or unfertile queen, or even from a fertile worker, they prove on dissection to possess virile organs equally perfect.

(*b*) Peculiar Queens.—Queens have been known to vary in size from real giantesses to no larger than ordinary workers. As a rule queens will not sting, whatever amount of irrita-

tion they may receive; but three instances are recorded from Germany in which, by the most persevering efforts, bee-masters have succeeded in obtaining this rare distinction from the royal mother, one of them noticing that the effect was little more than that of the prick of a needle. It is held by some that the queen's sting is of use in guiding the eggs to the bottom of the cells. At any rate, in one of the above three instances the queen lost the entire faculty of laying for the rest of her existence. There are queens again that will not fight when challenged to a royal combat; others that will not start when the swarm is all ready (Dzierzon relating that three successive swarms were led off by *young* princesses from one of his hives in consequence of the persistent refusal of the proper sovereign).

(*c*) Aberrations of Instinct.—Many instances of what appear to come under this heading, or at any rate are inexplicable whims, are manifested in respect to swarming. Not to speak of the above-cited obstinacy of the queen, the bees as a body sometimes neglect all preparations by means of royal cells, and then on the arrival of warm weather they suddenly rush forth and leave the remainder of the stock to begin these after their departure. Again, in preparing these cells, they have been known to omit the royal jelly; while the larva itself has been found with its head downwards, in which case, being unable to gnaw its way out of the cell, its life has necessarily been lost (the reversal in the case of foul brood is supposed to be owing to the struggles of the grub). The queen, too, will sometimes lay several eggs in the same cell, though fertile workers are more likely to be guilty of this freak. The occasional instances of bees murdering their queen may very probably be explained as the outcome of individual ambition begotten by partaking of royal food; but the desperate attempts of a queenless stock to hatch a queen out of a drone egg or a lump of pollen, have received no apology except that of Von Berlepsch, who compares such acts to the clutchings at straws made by a drowning man.

5. *Orthographical Variations.*—We trust that a brief allusion to this point may be accepted by our readers in the

spirit in which it is made—that of a sincere wish to contribute towards the settlement of one or two trifles which are occasions of confusion to many who do not express their doubts in print. Particularly, what is the proper English plural of the word "proboscis"? Of course, it is a Greek word, and if we follow the original, as Mr. Cheshire, fortified by Webster, does, we shall write "proboscides." No one can say that this is *wrong*, and yet does it not sound to nearly every one as *unnatural?* The word has acquired a recognised English footing, and our regular plural for words ending in *is* is formed by changing that syllable into *es*—perhaps from following the Latin, which does so with Greek words whose original plural ends in *eis*. At all events, it is certain that foreign words do creep into English use, in the case of which any person adhering to the foreign plural would be set down as a pedant forthwith ("genius," "terminus," and "aquarium" for instance). It is very easy in scores of instances to show the incorrectness of usage; yet after all it is usage that makes the language, and when it once is settled we cannot override it; thus we would even adhere to the English plural "chrysalises," irregular as it is, in preference to the technical "chrysalides." Even if the similar plural of "proboscis" could be considered just tolerable in the case of insects, yet could we any of us ever bear to say "The *elephants* raised their proboscides"? We have referred the matter to Dr. William Smith, the philologist, and he, without offering a dogmatic opinion, replies that his own preference would be to write "probosces."

We have been asked whether the word "apiarian" can be properly used as a noun. Custom has perhaps by this time sanctioned it, but "apiculturist" is much the safer form.

The proper name "Réaumur," if left without the accent, as nearly all apiarian authors persist in writing it, becomes cut down from its correct three syllables to two. We have been at pains to investigate the matter by means of French biographical works at the British Museum, and as the result, we have not a shadow of a doubt that the omission of the accent in English use had its rise in the first place in an ordinary piece of carelessness.

B.

New Section Frame.

(By Rev. F. R. Cheshire—*Journal of Horticulture*, Feb. 5, 1880.*)

It is now well known to all apiculturists that bees build combs more quickly at the sides of the brood nest than they do over it, while in the former position they are much longer sealing the honey. This doubtless has its foundation in the fact that the necessity or even opportunity for building comb above the brood nest is strictly artificial, while that position is the one above all others favourable to the evaporation of excess of water in the gathered nectar; hence here comb-building is less active, while sealing is most rapidly accomplished. Almost all true progress is the outcome of correct observation, which in this case gives the basis for the suggestion that sections—*i. e.*, small boxes containing a single slab of comb honey—would be produced most rapidly, all other things being equal, by being *started in the hive body* and *finished in an upper story*. To meet this acknowledged need most of the better hives exhibited during 1879 contained wide frames to take sections, to hang by the sides of those devoted to the work of the nursery. But in practice these frames are exceedingly troublesome and inconvenient, for any trifling error in measurement is likely to make the sections either too tight or too loose; and though the latter defect would appear to be the less perplexing, it is hardly so, for all spaces the bees most conscientiously close with propolis, which gives us much trouble in rearranging for the upper story. To overcome this difficulty I devised the frame, if frame it can be called, which was exhibited at Long Sutton and received a special prize. The top bar of the frame is omitted, while the ears are fixed firmly to the tops of the ends. The angle at one bottom corner is a rigid right angle, but that at the other is

* Besides abridgment, some trifling verbal alterations have been necessary in this article on account of its having been originally accompanied by illustrations. These, however, may readily be dispensed with, and the reader has only to imagine a frame without a top bar, but with its sides and bottom so widened as to be exactly equal to the depth of the section boxes from front to back. These then lie across it side by side and in two tiers.

hinged. As the frame or holder stands in front of the operator, the hinged side falls upon the table, and the lower tier of boxes is placed in position, the first box being pushed to the rigid angle. The upper tier follows, when the movable side is raised, and all are at once held together. The weight of the frame and boxes, as the former hangs in the hive, serves to keep this side to the perpendicular, while the strips of tin for separators [between frame and frame] may be most expeditiously fixed by four ordinary drawing pins for each, which will do duty an indefinite number of times, and so in the long run prove no more expensive, although immensely more convenient, than common tacks. The separators need not be pierced with holes; but if all be kept, as they ought to be, of one gauge, then the drawing pins can be permanently fixed in the uprights of the holder above and below the separator, and their broad flat heads will give it every security. I said permanently, because the removal and replacement of the pins is by no means needful; for when the upright of the frame is brought into position, the ends of the tin slip can in a moment be passed in behind the pins, and if a small amount of curl be given to it, and its round side be placed next the section boxes, it will rather press against them than show any tendency to sag away.

When it is desired to remove the boxes, after lifting the holder from the hive, the hinged upright is drawn away, and the separators are at once freed, while the first section at the top open end presents two of its sides to our unimpeded grasp, permitting us without jar or wrench to part it from its fellows, which can in turn be handled in the same facile manner. To refill the holder with empty boxes and to readjust the separator is but the work of a few moments.

Facility in the removal of sections is of greater moment than simply giving comfort and saving time to the operator. Difficulty here means frequently some fracture, at first perhaps slight and almost imperceptible, in the attachments of the comb, but this sets the honey bleeding, while the comb loses its evenness of tone, for a reason some may not have observed. The air-tight waxen covers which we call sealing do not touch the enclosed honey unless the cells get slightly damaged; the covers then

become semi-transparent, losing their solid white character, much to the disadvantage of the appearance of the comb.

For heavy supers, solidity—*i.e.*, rigidity of build—is of primary consequence, for the reason sketched above, and on this account no supers of wood do I find in any way comparable to the Stewarton. Splendid slabs of honeycomb in these will bear an amount of handling which would bring most others to grief, or at any rate start running, which would involve loss of beauty as well as weight.

C.

German Beehives.

On page 84 we have remarked upon the peculiar, and to our ideas strange, construction of one of the favourite German hives. With that people, however, as with ourselves, there exists a very extensive variety; and if the adoption in that case of a seemingly erroneous principle should lead some of us to conclude that German bee-keepers are as much our inferiors practically as they are our superiors in a scientific point, it may be amusing on the other hand to read the contemptuous judgment which Von Berlepsch passes upon the practical skill of *everybody but* Germans. "In all other countries," says he, "bee-keeping is at the present date almost from beginning to end a mere plaything and fancy, which, instead of bringing in money, causes money, and often a great deal of it, to be expended." Thus, if we are tempted to a low opinion of the practice of the Germans, we see that the feeling is more than reciprocated.

We here reprint from the *Floral World* a detailed description of one of the better-class hives of this nation, as given in a portion of a paper upon "Bee Culture," read before the Inventors' Institute by Sir Thomas Tancred, Bart. The placing of the hive upon the bare ground, as in the figure, is of course not an essential, and one would think it must be merely an error of the engraver's.

In order to obtain the testimony of a disinterested writer

as to the essentials of a good hive, I will cite, not a German, but a French author. I find these essentials well summed up by the latest French writer on this subject with which I am acquainted, the Abbé Sagot, in his "Culture des Abeilles:"—

"Every hive which does not allow artificial swarms to be easily made without stupefying the bees, and the honey to be taken without disturbing them or destroying the brood and the provisions necessary for it, is defective, and will soon discourage a bee-keeper, instead of inducing others to imitate him. The best hive, therefore, is one which, whilst agreeable to the nature of the bees, at the same time allows their possessor to execute with ease all the operations belonging to apiculture—such as a complete inspection of the combs at the opening of spring, prompt and plentiful feeding when necessary, propagation by artificial swarms on any day required at the will of the manager, without having to mount guard over the hives for weeks, and to race across country in pursuit of natural swarms; easy extraction of the purest honey as often as it may be suitable, without deranging the bees in their work, and without destroying a single particle of the brood, or of the provisions stored up for it; means of emptying the combs so as to replace them to be refilled by the bees without their being called upon to waste the best honey season in providing new ones; lastly, instantaneous reunion of bees in October without stupefying or drumming them out, and without any fighting. Such are the advantages, in general little known, very little practised, and often impracticable in many sorts of hives, yet most necessary to make apiculture an agreeable and useful occupation."

These requisites were never really combined in any single hive, though some of them might be more or less imperfectly attained, till Dzierzon brought out his exceedingly clever idea of making *each comb* movable, so that every comb could be taken out and examined separately; and not only so, but all the hives in the apiary being exactly of one diameter, no matter how different in other respects, any comb in any one can be interchanged with any comb in any other. In this

way throughout Germany the hives made on Dzierzon's principle, whether of straw, wood, or other material, and however different in internal capacity, are on a uniform gauge of

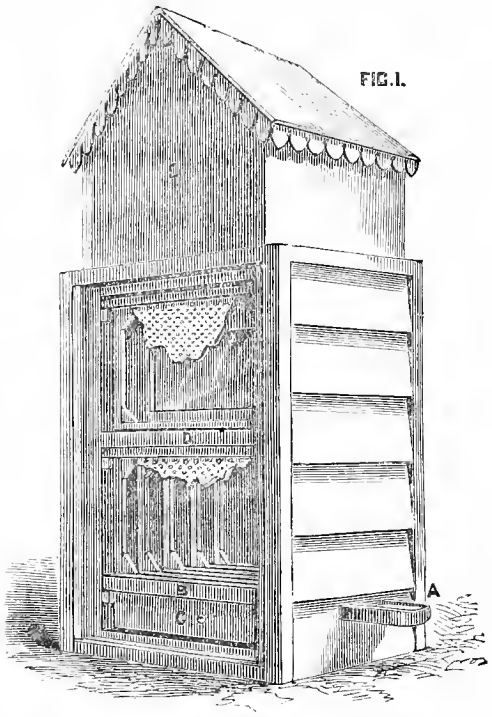


FIG. 1. Brood Hive.—A, Lighting-board. B, False bottom. C, Stopper inserted beneath false bottom. D, Double ties of sliding frames. E, Cover surmounting the honey-box.

9⅞ English inches. In addition to securing all the requisites above stated, this improved German hive admits of contracting or expanding the space occupied, by pushing forwards or drawing back a sliding glazed sash at each end, as I will presently show you.

Now, asking you to keep in mind the requirements enumerated by the French apiculturist, I will give an explanation of the peculiarities of the hives before you (see Fig. 1). You will observe that the hives are distinguished by a letter, a

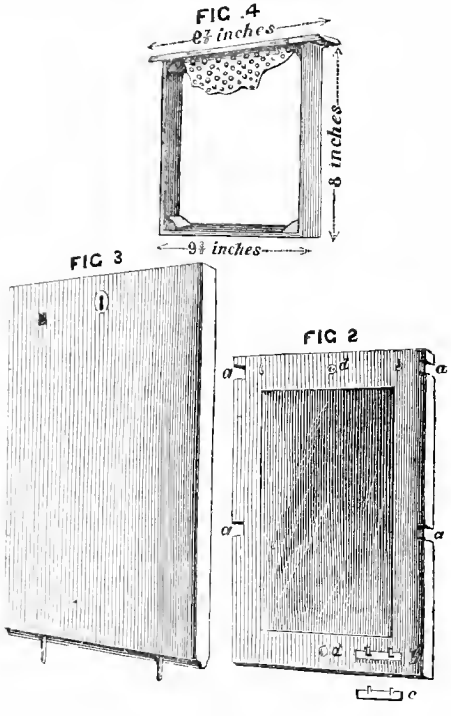


FIG. 2. Sliding glazed sash.—*a a a a*, Recesses corresponding to fillet in hive. *b*, Aperture for insertion of a smoker for quieting bees. *c*, Stopper for closing the aperture.—FIG. 3. Door of hive.—FIG. 4. Movable frame.

number, or a name, which should be entered in a note-book, which can be easily carried in the pocket, in order that notes may be made on the spot when any hive is examined, so that important particulars about each may readily be referred

to without any mistake. These letters, numbers, or names being written in capitals and Roman numerals at one end, and on all the parts belonging to that end, and in small letters or Arabic numerals at another end, the parts so marked can readily be replaced, so as to fit whenever the hive is opened. The weight also of the empty hive should be inscribed upon each, so as to be able readily to ascertain any increase or diminution of the variable contents. You observe I take my keys from my pocket, which may also have the distinguishing mark of each hive upon them, and open the outer doors (see Fig. 3). No hinges are employed, as they are apt to crush bees, though, if preferred, they might be fitted to the bottoms of the outer doors, but the plan adopted is more simple.

Within the outer wooden doors, cushions of tow, wool, wadding, &c., are kept against the glass of the inner sashes to make them warmer. These inner sashes, you will observe, slide to and fro on fillets or runners, so as to enable me to expand or contract the interior capacity of the hive at will. In winter, a comparatively few combs partly filled with honey are required by the bees, and the empty ones being removed and stored up safely, the sliding sashes may be moved towards the centre, and pasted over with paper, the space between them and the outer doors being filled with tow, dry moss, hay, &c., so as to keep the hive entirely free from draughts. The combs are to be worked in these sliding frames (see Fig. 4), as you see by the one partly filled with honey. In order to induce the bees to work their combs straight and parallel within the frames, a strip of guide comb is fastened along the under side of the top bar of each frame, by means of a mixture of bees-wax and resin melted in an iron spoon over a candle or lamp, as you see. Each frame is made to hang at a defined distance from centre to centre, so as to admit of a passage for the bees between every two contiguous combs when arrived at their proper thickness, the width of the widest part of the frame being $1\frac{1}{4}$ inches. This is important in the under or brood box, but in the upper or honey box the interval may be greater, as the bees

will prolong the cells and make the combs of greater thickness when intended only for storing honey, than they would if intended for rearing brood.

There are twenty-four combs in the hive when expanded to its greatest capacity, and as each frame contains a superficies of 9 in. × 8 = 72 square inches, the whole of the combs in the brood box occupy a superficial space on each side of 1728 square inches. When this space, or nearly as much, has been well built up and filled with combs and bees, the stopper at the top being taken out, an entrance is opened through a wooden grating to the honey box placed above it, by which it is expected that the dame or mother-bee will be prevented from entering this box, so that only virgin honey will be stored in it.

Following the example of the German model, I at first made the honey box with outer wooden and internal glazed sashes, &c., just like the stock or brood hive; but, in considering the subject, I found that I was going to a needless cost in this respect, and I now make them much more simple and inexpensive, as in the one I now exhibit.

The false bottom of the lower box, being formed of separate thin boards, can be easily taken out, either for the purpose of cleaning out the dead bees and other refuse in spring, or for introducing a shallow feeder at that season, whilst the stops at each end keep any bees from escaping below the glazed sashes.

The lighting-board is made to take off, in order not to be inconvenient in travelling; and if the hive be moved when peopled with bees, by fixing a piece of pierced zinc in front of the entrance, as well as over the opening on the opposite side, a thorough draught can be established to keep the hive cool on a journey.

I have thus explained the construction of the improved German hive, and I have here some varieties of structure adapted for particular purposes and operations. I believe that the more practically acquainted any one is with bee management, the more he will appreciate the complete control over a stock of bees afforded by these hives. To pretend to

describe all the ways of using them in detail would evidently be impossible within the compass of a lecture; to do so would be to give a complete treatise on practical bee-keeping. I can only assert that there is no operation possible with bees which cannot be performed with these hives, and I believe more easily than with any other yet invented.

D.

Mr. Cowan's System of Working the Bar and Frame Hive.

(From *The British Bee Journal*, March 1, 1875.)

It is with much pleasure that I now comply with the request of some of your correspondents to give them my system of working the Woodbury hives, which has enabled me to obtain such large supers of honeycomb. The method is very simple, but is one that requires much attention, which is, however, well repaid by the extra quantity of honey obtained. The hives I use are the ten-frame Woodbury, and thirteen-frame on the Woodbury plan, only longer. In the autumn I transfer the bees into clean hives, and leave them seven to eight frames, and should they be short of food or of bees I add those that I may take from the cottagers in the neighbourhood. I feed with sugar and water of the strength of two pounds of sugar to a pint of water, boiled up for a few minutes. They are fed up to weigh about thirty pounds. During the winter they have ample ventilation, the hives being raised about one-eighth of an inch from the floor-board, and the top-board is also raised about the same height, so that there is a constant current of air through the hive.*

While I am on the subject of wintering, I may mention that I have tried several plans. With the above I have always been free from mouldy combs. I have also tried wintering without crown-boards, by merely placing an empty super on the top, and I have done so successfully—in fact,

* See remark on page 244.

the hive which produced the largest quantity of honey last year was wintered in this way. Condensers I have tried, but give the preference to crown-boards without them. I am trying the quilts this winter on some of my hives, but must reserve my opinion about them until later on.* I generally supply my bees with plenty of food in the autumn, so that they require no further attention until about the end of February, when, if the weather is fine, the bees are all thoroughly roused into activity, and induced to commence and to continue breeding until the honey-gathering season commences, by which time every frame in the hive is filled with brood, and the hives are so strong that it is easy to make an artificial swarm, and to ensure a good supply of honey besides. If the weather is fine about the end of February (or if cold then, I defer it a little longer), the bees are transferred into clean hives; and in this way I get to know the exact state of the community. Now, suppose it is a ten-frame Woodbury hive, I do not return the whole of the eight frames which the bees had for wintering on, but only from five to six of the centre ones, and contract the size of hive to the six frames. I then unseal the honey-cells of two of the frames, and allow the honey to run down inside the hive. This thoroughly rouses the bees; and the queen at once begins to lay. The running honey is very soon collected and stored; and in a few days I do the same with a couple more frames, and so on, until all the frames have been unsealed. I find this a great advantage, as much of the honey that has granulated, and which the bees will not touch, is removed by them out of the hive, and gives them increased space.

I now commence very gentle feeding, for which purpose I use the very fine strainers found in Loysell's coffee-percolators, and allow each hive from a quarter to half a pint

*We have written to Mr. Cowan in respect of this matter, and received the reply that he sees neither the great objection that some do to these appliances, nor yet the indispensability attached to them by others. In his more recent paper quoted under "Winter Management," it will be seen that he has recurred to their use, though under a modified arrangement (see page 98).

of food a day, of the strength of about three pounds of sugar to one quart of water. When there is sealed brood in three or four of the frames, I add two more—making eight—and serve them in the same manner as the rest; then when there are six with sealed brood, the colony will be sufficiently strong to have the remaining frames added. The same plan is adopted with the thirteen-frame hive. They must be constantly watched, so as not to allow them to store too much food, which would diminish the space available for egg-laying; and if such is found to be the case, food should be withheld for a day or two, or until they are getting short of it. In this way I keep them going from day to day, watching them carefully, or it might happen that a hive full of bees—and at swarming point—might, if not watched and supplied with requisite food for existence, starve or decamp. So, by the time there is an abundance of honey abroad, the hives are completely filled with bees, and contain brood in every frame in the hive; and then it is that I put on my supers, and discontinue stimulative feeding.

In place of the crown-board, I place a sheet of perforated zinc, with openings of five twenty-fourths of an inch, and supers same size as hive, and five inches deep. The supers are provided with bars, which are sawn down the centre, enabling me to fix a strip of impressed wax-sheet without any difficulty. The bees generally take to these supers at once; and in a day or two the crown-board of super is removed, and I place a second super on the top of the first, or sometimes I interpose a second super without top-board between the first one and stock-hive. The supers are also provided with traps to enable bees to leave them after they have deposited their load, instead of passing through the stock-hive. Now it sometimes happens that for some days the weather is fine, and the bees begin storing a large quantity of honey in the supers (as they have no room in stock-hive), then suddenly the weather changes and cold and wet set in. As soon as this happens I remove supers and watch the bees, and if they require small quantities of food I give it to them, and when the fine weather returns they go

on again in the supers when replaced on top. In this way it sometimes takes only a week to fill a thirty-eight or forty pound super with some of the best honey that can be obtained in this part of the country. If I have not made myself sufficiently clear I shall be pleased to answer any questions that may be put to me. There is one thing I forgot to mention, and that is that I discard old queens, and generally select young and prolific egg-layers.—T. W. COWAN. *Horsham, February 22nd*, 1875.

E.

AMERICAN HONEY.

The following interesting account of the production and exportation of American honey appeared in the *Times* in the early part of 1879:—

An experiment which has been successfully carried out by a firm of American wholesale grocers is noteworthy as the first step to the introduction, probably on a large scale, of American honey in the comb. Last year a considerable trade was done in the exportation of honey from the United States to Europe, one New York firm alone sending over 300,000lb. of honey, principally to Great Britain. The bulk of this, however, was sent in jars, either as pure extracted honey, or as comb honey—that is, honey bottled with portions of broken comb remaining in it. In the United States, however, honey when sold in the comb commands a much higher price than the honey sold in jars, and the efforts of honey-dealers there have long been directed to the production of small, clean, compact, and perfect sections of honeycomb, in a form readily saleable by the retail grocer. This object has been effected by placing sets of small boxes in the upper part of the hives for the bees to store the surplus honey in, and as each box is filled it can be lifted out and replaced by an empty one, in which the bees may continue their labours. These boxes are now commonly made with four glass sides and a strip of

wood at top and bottom. In size they are a square of five inches on the side, by two inches in thickness, and a dozen of them are packed together in a crate for shipment. The advantage of using this particular form of box is that the bees finish off the section of comb in the shape and quantity found to be best adapted for sale, and the seal of the bees upon each cell is the best guarantee for the purity of the contents. The difficulty of exporting these delicate pieces of comb, without the loss of a great part of the shipment by breakages, has hitherto prevented the growth of what might doubtless be a lucrative business. During four years Messrs. H. K. and F. B. Thurber and Co., of New York, have tried to get this comb honey to England in good condition, but without success. The want of proper machinery for unloading the ships seems to have been the principal cause of the damage. Let down "with a run" by a sling from the yard-arm, the glass boxes and their fragile waxen contents were again and again broken and spoilt. In November last, however [1878], Mr. W. M. Hoge, the manager of this firm, succeeded in landing a consignment of 80 tons in Liverpool, and, encouraged by the result of the venture, he on Thursday, January 9, landed at the London Wharf in Wapping, a lot of about 100 tons, brought over in the "California," one of the Anchor Line of steamships. There are 2500 cases in this shipment, containing over 200,000lb. of honey, and few boxes have sustained any injury in transit. Taught by past experience, Mr. Hoge had his cases securely boarded up between bulk-heads on the steamer, and in unloading employed gangs of men to pass the cases hand-over-hand down the ship's side into the lighter, and from the lighter on to the wharf. Visitors to the Paris Exposition, where Messrs. Thurber and Co. obtained a medal for their honey, as well as one from the French Agricultural Society, for the best honey in the most marketable form, may remember the exceedingly neat appearance of the honeycomb in these patent hive boxes.

The importance which bee-keeping has assumed as a regular branch of industry in the United States, may be conceived when it is stated that over 35,000,000lb. of honey are there

produced and sold annually. The tendency in this, as in other occupations, has been for the trade to be carried on by persons having large capital. The bee-keepers have frequently from 2500 to 5000 swarms of bees, and some far larger numbers. Messrs. Thurber and Co., for instance, have about 12,000 swarms of bees. Of course it is only by a thorough organisation that such large numbers of these little workers, who toil without pay, can be looked after and cared for. The system in the United States is to farm out the swarms. Arrangements are made with farmers, and those who own orchards in suitable localities, to allow an apiary, of perhaps a hundred swarms, to be placed in their grounds. At a distance of three or four miles another apiary will be placed with some other farmer. For this accommodation either a fixed rent or a share of the honey produced is paid; and the bee-owner sends expert workmen to clean out the hives, to take out the boxes of surplus honey as they are filled, and to destroy the moths, grubs, and other creatures that take advantage of the bees' frugality. As showing the lucrative character of this business, it is said that a firm of shippers paid to one bee-keeper, for his season's crop of honey, a sum larger than the salary of the President of the United States. It is estimated that on an average one acre will support twenty-five swarms of bees, and, as the yield of a swarm is generally about 50lb. of honey, it is evident that this trade may yet be greatly developed. Already the firm above mentioned, in addition to a corps of experienced bee men to tend the hives, find occupation for nine men and two steam saws during five weeks of the year, in cutting up the timber for the 72,000 boxes used to hold the comb honey. The glass-makers also find some custom from the honey-dealers, 144,000 panes of glass being required to make the slides and ends of these boxes.

Much attention has been paid in the United States to the improvement of the breed of bees, and queen bees have been imported from Italy, Cyprus, and elsewhere, for the purpose of improving the stock. Some years ago fine Italian queen bees were sold for as much as £10 each in New York; but

by forming nurseries, and rearing queens carefully selected from fine broods, queens of good blood—if a term may be borrowed from the turf—may now be bought at prices ranging from one dol. to five dols. each.

Side by side with improvements in the culture of the bee, too, there have been many ingenious contrivances introduced in order to save the time and labour of the bees, and of the honey-dealers. About ten years ago a German suggested that thin corrugated sheets of wax, which he called "artificial tablets," should be provided for the bees to make their comb from. These, however, did not come into general use, but a few years ago Mr. W. H. Hoge effected an improvement by starting the side walls of the cells. When these "foundations," as they are called, were presented to the bees, the intelligent little creatures at once took advantage of them, and extended the side walls so as to form the regular hexagonal cell. The machine by which the impression is made on both sides of the wax is very simple, and somewhat resembles a clothes-wringing machine, only the iron rollers are studded with little hexagonal-headed pins, just the size of the section of a cell, so that when the thin sheet of wax is passed through, the wax is pressed up between the pegs, to the height of about one-sixteenth of an inch, thus indicating the position, and offering the substance for the construction, of the cell walls. Another remarkable adaptation of machinery is afforded by the use of a rotating frame, which causes the cells of the comb placed in it to be emptied by centrifugal force. The empty, uninjured comb is afterwards replaced in the hive, and again used by the bees. As about three-fourths of the time of the bees, it has been computed, is taken up in the construction of the comb, it will be seen that by these contrivances a great saving of bee labour is effected.

With the rapidly-increasing supply obtained by this well-organised system of bee-keeping, the dealers in honey in the United States are already trying to open new channels for trade, and to create fresh uses for the product of the hives. With this object in view, a prize has been offered by the American Bee-keepers' Association, for the discovery of a

method of converting honey into the form of a crystalline sugar. Looking forward to the time, not, probably, far distant, when honey will be produced as cheaply as raw sugar—honey may now be bought wholesale for seven cents per pound in California—the dealers hope to be able to provide a substitute for glucose, which will equally well serve the purpose of the cook, the confectioner, and the brewer.

F.

Bees and their Counterfeits; or, Bees, Cuckoo-Bees, and Fly-Bees.

We here reprint from the *Intellectual Observer* of April, 1862, an instructive and interesting article by Mr. H. Noel Humphreys :—

No insect is so well known to our unentomological public as the hive-bee of North-Western Europe. All the habits, peculiarities, and interesting social arrangements of this insect have been popularised in a series of works, the public appetite for which never seems satiated, and so new volumes upon this never-failing theme, always possessing more or less merit, are continually issuing from the press. But although the natural history of our common hive-bee (*Apis mellifica*) has been thus rendered so familiar, the other members of the bee family have found but few popular historians, and less is generally known about them—except to entomologists—than about other far less interesting insect families.

Yet there are many interesting peculiarities connected with different species of the bee tribe which would amply repay the cost of a little study. I may, therefore, within the limits of the present paper, call attention to a few remarkable kinds of British and foreign bees, more especially with reference to certain extraordinary resemblances which exist between some of the honey-collecting kinds and those belonging to the parasitic or cuckoo class; which will lead to the notice of still more curious resemblances that exist between bees and certain insects

belonging to a distinct order, *Diptera*. These last, though only furnished with two wings, while the bees, and the whole order (*Hymenoptera*) to which they belong, have four, yet bear such a striking resemblance to the bees in company with which they are found, that an untrained observer would not, at all events on a first glance, perceive the existing difference.

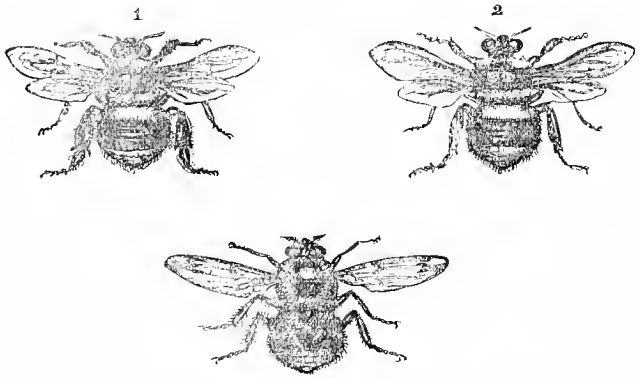
The bee family was termed by the great French naturalist, Latreille, *Mellifera* (honey-gatherers), or *Anthophila* (flower-lovers), both terms being characteristic of the general habits of the family. One of the most remarkable features in those kinds of bees which live in societies, as is well known in the case of the hive-bee, is the existence of [what was formerly called] a third sex, the neuter or worker; and there are other singular peculiarities of this kind in less known species, such as the existence of two distinct kinds of females. The material of which the egg-cells are composed is very various. The comb of the hive-bee, as is well known, is formed of wax, secreted in a peculiar manner, as described in hundreds of popular works; but other species, though forming a comb almost identical in appearance, make it by the manipulation of certain substances which they reduce to a material more analogous to common manufactured paper than anything else; while others, again, make cells with sand, moistened with a glutinous secretion, which reduces it to a kind of tenacious cement. Some of these species, again, collect an inferior kind of honey, while others only collect pollen, of which they place a small mass or ball in each cell in which an egg is to be deposited, so as to form a supply of food for the grub or larva to subsist on till full grown. The exactly sufficient quantity is prepared by the instinct of the parent; and, in fact, when that is consumed, the young grub bee has no choice but to subside at once into the torpor in which his change of organisation is to take place. This is a necessity, as he has no powers of locomotion, being a clumsy maggot-formed larva, which, placed at the bottom of a smooth-sided cell, would have no means of seeking food for himself. The tribes of parasitic bees which do not make cells to contain honey or pollen for the separate use of each infant bee, visit the nests of their more industrious cousins, and surreptitiously place an

egg of their own in the cell containing the honey or pollen, as the case may be.

It was formerly believed that the egg of the parasitic bee was placed in the same cell with the egg of the honey-bee, and that, being hatched first, the young parasite devoured all the food, leaving the infant of the honey-bee to find himself born to an empty larder, and consequently speedy starvation; but more recent observation has led to the conclusion that this is not the case, but that the parasitic bee, on entering the nest, selects cells already furnished with honey or pollen, but in which no egg has as yet been laid; while the unsuspicious female proprietors of the nest, finding an unexpected egg deposited in the cell they first visit, exhibit no sign of surprise, but pass on to the next, not seeming to be at all disturbed by the presence of the uninvited deposit; just as small birds make no attempt to exclude the egg of the cuckoo, but hatch it, and rear the young intruder along with their own offspring.

This occurs in the nests of wild bees constructed in different situations, some kinds making an excavation expressly, others adopting the deserted work of some other insect, or taking advantage of an accidental hollow. For instance, *Anthidium manicatum*, one of our summer bees, generally uses the holes bored in willow stumps by the *Cossus ligniperda;* but a nest of this species was once found, as described by Mr. F. Smith, in the keyhole of a garden door. Some of the humble-bees, on the other hand, carefully construct their own burrow. A beautiful exotic species, a large and powerful bee, has received the specific name of *latipes*, from the singular broadening and strengthening of the front pair of feet. These broadened feet assume somewhat of the character of the front feet of the mole, or rather those of that curious insect the mole cricket. These enlarged feet, with the thick brushes of strong hairs with which they are furnished, are evidently excavating implements, and no doubt the works produced by their agency are of a very interesting kind; but entomological discovery has not at present made us acquainted with the nest architecture of this handsome insect. A pretty little English bee, one of the solitary kinds, often makes its burrow in sheltered parts of hard gravel walks,

an affair evidently of very great labour, as the female bee, who is the sole architect in this instance, frequently comes to the opening of the burrow to rest, when the male commences flying rapidly round and round his mate with great rapidity, as though to encourage her to renew the task.



I am not aware whether the nest of the little bee of the gravel walk is subject to the visits of a parasitic cousin, but among those most subject to intruders of this kind is that of the common garden humble-bee, *Bombus hortorum*. In the engraving above, this pretty bee (Fig. 1) is engraved side by side with its parasite, *Apathus barbutellus* (Fig. 2). These bees bear such a generally close resemblance to each other, that one may easily be mistaken for the other, even by the initiated, till after a close examination, as colour, size, and general form are almost identical. There is, however, one marked difference, which is easily perceived when the trained eye has been taught where to look for it: the hind legs of the honey or pollen collector are invariably furnished with an enlarged tibia, the flattened and somewhat hollowed breadth of which serves as a reservoir, in which the pollen collected from flowers is carried to the nest. This peculiarity of formation will be observed in the engraving, Fig. 1, whilst in Fig. 2 the

same part of the hind leg will be found simply rounded, and entirely without that broadened, flattened, and hollow character which distinguishes the hind leg of the honey-collector. This parasite, having neither the instinct to collect food for its expected progeny, nor, in fact, the means of carrying it home, even if the will existed, has been deemed by naturalists to be entirely devoid of those parental and home instincts which distinguish the recoltant or harvesting kinds. It is on that account that it has, like the genus to which it belongs, received the name of *Apathus;* apathy in regard to the providing protection or food for their young being the leading characteristic of parasites. It will be observed that the light band on the thorax, near the head, is less distinct in the *Apathus*, and also that the abdomen is not quite so profusely furred. Latreille termed these parasitic bees *Cuculinæ*, or cuckoo-bees, the term *Apathus* having been substituted by an English naturalist.

The resemblance of the third insect figured in the group above is still more curious. Although, at a glance, it so much resembles both the bees represented in the engraving as to cheat the careless observer, it will on closer examination prove itself not only far from being identical, but will be found so radically different as at once to show that it belongs to another and distinct order of insects, the *Diptera*, or two-winged order. It is, in fact, merely the general size and the colouring which deceive the eye untrained to appreciate anatomical form with accuracy. On examination, almost every part of the structure will be found to be exceedingly distinct from that of the bee: the eyes are differently placed and different in form, while their size and colour are nearly identical; the antennæ, instead of being horny and robust, like those of the bee, are delicately slender and feathered, like some kinds of moths—but these are not conspicuous appendages, and escape the attention of the ordinary spectator. The thorax, or fore part of the body, is, however, furred with orange hairs next the head, which become yellow near the abdomen, leaving the centre of the thorax black; the segments of the abdomen nearest the thorax are clothed with yellow fur; the central segments are black,

and the last segments, or tail, are white. This is precisely the colouring of both the bees (Figs. 1 and 2); but then the single pair of wings, the legs without the enlarged or honey-bearing tibia, and even the anatomical structure of the body itself, though under the disguising fur mantle of identical colour, is of itself amply sufficient to denote that the insect belongs to another and very distinct class.

Still, the close general resemblance of this insect, *Volucella plumata*, is indisputable, and as it passes into the nest of the bee, in order to deposit its eggs (one to each) on many of the living larvæ of the bees, it might certainly, to a casual observer, pass for one of the family, while entering the bees' nest on its mission of murder to the infant bees in their cell-cradles. The egg of this parasite, being deposited in the warm folds of the soft skin of the bee larva, is rapidly hatched, and it at once proceeds to its unnatural feast, slowly devouring the foster parent whose breast had warmed it into life; the bee larva, as I have stated, being a soft, legless grub, with no powers of escape. The larva of the *Volucella* is an odious-looking creature, with its broad tail armed with sharp spines, and its muscular body tapering to the head, and furnished with rigid serrations along each side, forming a striking contrast to the soft, helpless larva of the bee. Like all the larvæ of the *Syrphidæ*, to which the genus *Volucella* belongs, it is blind; but resting attached by the broad tail, it moves its head rapidly about as a feeler, before changing its position. The spikes at the tail may be adapted to enable it to raise itself up the smooth sides of the cell of the bee larva, in case that one infant bee should prove insufficient, and that it might require to pass on to the next cradle. But it may be as well to describe the progress of the parasitic larva on the supposition that one baby bee will prove enough for its purpose. The devoted larva of the bee, then, is gradually eaten alive by the parasite; which, with seemingly horrible instinct, spares all the actually vital parts, taking only the more fleshy portions, until the carnivorous young *Volucella* feels itself full fed and ready to undergo its torpid state of change. Then the last remains of the wretched infant bee are greedily consumed, and the parasite passes into its sleepy

chrysaline stage, taking its long *siesta* in the comfortable cradle whose infant tenant it has devoured, and from which it eventually comes boldly forth in all the pride of its winged and perfect state, walking out of the bee home as from its own proper abode, and attracting no notice whatever from the bees, in whose nursery it has performed the odious act of eating a baby bee, and appropriating its comfortable cradle cell. The stolid unconsciousness with which the bees allow this insect vampire to pass out and escape from the scene of his horrid proceedings with impunity, has induced some naturalists to believe that the carnivorous *Volucella* owes its safety to its complete disguise in the colouring of the bee, which is supposed to be so perfect as to deceive the bees themselves into the belief that these strangers are members of their own fraternity. Mr. Westwood, quoting Messrs. Kirby and Spence, in their admirable work, in which the habits and instincts of British insects were first classified and grouped together in a pleasantly readable form, makes the following statement on the likeness of the *Volucella* to the bee: "This similarity to the humble-bee is of eminent service to the insects which deposit their eggs in the nests of those bees, an admirable provision of Nature, since, as Messrs. Kirby and Spence observe, 'did these intruders venture themselves among humble-bees in a less kindred form, their lives would probably pay the forfeit of their presumption.'" This statement, however, though appearing so plausible, is not borne out by analogy, there being many parasites on bees which do not bear the slightest resemblance to the insects whose nests they invade. Not only are some of the *Diptera*, who deposit their eggs in the nests of bees, very unlike the bees whose homes they infest, but even the parasitic bees themselves do not always resemble the bees whose nests they appropriate. For instance, the species *Eucera longicornis* has a *broad* brownish body, without any conspicuous mark, while its parasitic relative, *Nomada sex-fasciata*, has the *narrow* body of a wasp, and, as its name implies, six conspicuous yellow bands on the abdomen, which, with the intermediate black spaces, make it a very distinct-looking creature indeed.

In some of the exotic bees more especially, the distinct

aspects of the harvesting bee and the parasite are very striking; they are, in fact, so much so, that the insects might be thought to belong to entirely different families. The beautiful Brazilian bee, *Euglossa dimidiata*, has an attendant parasite as totally unlike it as it is possible to conceive of insects of the same order. *Euglossa dimidiata* is one of the most beautifully and variously coloured of the whole bee tribe. A specimen was captured by Mr. Bates, at Para, in the Brazils; and it is found in other tropical parts of South America. Latreille described this handsome species in Schomberg's "Fauna of British Guiana;" but it had been previously described by Fabricius, from specimens taken at Cayenne, and named by him *Apis dimidiata;* subsequent divisions of the family having rendered another generic name necessary, this beautiful species was attached to the genus *Euglossa*. It forms its nest by boring tubular hollows in large reeds, and there is a specimen of a reed in the British Museum bored in this manner by this bee, or by a bee belonging to a closely allied genus.

Into such a tube the parasite bee penetrates, for the purpose of depositing its egg in the cells which have been furnished with honey or pollen by *Euglossa dimidiata*. In this case, in order to support the theory of Messrs. Kirby and Spence, it would be more than usually necessary that the intruder should be furnished with a very complete disguise, as he must, in such a narrow tubular home, necessarily come to very close quarters with the master of the house. Yet, on the contrary, the whole aspect of the parasite of *Euglossa dimidiata* is not only extremely different, but its appearance is of that striking character calculated to excite immediate attention. Instead of being soft and furry, after the fashion of the humble-bee tribe and their allies, he is entirely hard, smooth, and glittering—the entire body, thorax and abdomen, and also the legs, being of a light vivid metallic green, like that of our rose-beetle. It might be urged, on the other hand, that although not provided with a security in the form of a disguise, a defence of another kind has been substituted, in the suit of impenetrable plate-armour, of magnificent green bronze, in which this insect is encased But I feel convinced that it is

entirely futile to attempt to explain the nature of providential arrangements, and point out the secret purposes for which either apparent analogies or discrepancies were devised. The best explanations offered, indeed, are too full of contradictions to be for a moment seriously accepted as revelations of intended purpose. As a ready example of the contradictions to which such speculations must be liable, I may mention here, that although the parasitic bee, which infests the nests of *Euglossa dimidiata*, is entirely unlike the harvesting-bee whose home he invades, yet the doubly-unfortunate *Euglossa* has a second enemy, in the form of a gigantic *Diptera*, whose similarity to the bee is most curious. This enormous fly-bee, *Asilus fasciatus*, has, it is true, only two wings, but these being of deep brown to half their length, and transparent for the remainder, bear an extraordinary general resemblance to those of the bee; while the colouring of this handsome insect being nearly identical with that of the bee, and the size and shape of the markings being almost identical, the general resemblance becomes very remarkable; hence the conspicuous appearance of one enemy is rendered utterly useless as a defence, while the seemingly perfect disguise of another apparently favours his fatal entrance to the nest.

There is a handsome bee, *Xylocopa nigrita* (the female); it is a native of Sierra Leone, and is remarkable for the full deep velvety black of the greater part of the body, while the sides of the abdomen are conspicuously fringed, and partly covered, with milk-white furry hairs; the effect of which calls to mind the appearance of an aged negro of the same part of the African coast, whose woolly hair has become white with age. The legs, also, are thickly fringed on one side with a similar white fur, and the "face" is white, with large brown eyes. The wings are nearly opaque, and of deep, dull purple, with a metallic gloss, bronzy-red towards the extremities. The *Diptera*, or two-winged counterpart of this insect, has all the characteristic contrasts of black and white, similarly disposed, even to the white face and brown eyes; while the opaque, iridescent wings are precisely similar in tone and colour. The somewhat longer legs, the single pair of wings, and the dif-

ferent structure of the antennæ, at once prove to the entomologist that these two insects are not only not the same, but that they belong even to different orders. They are, however, in all probability found together, like the other bees and *Diptera* which so strongly resemble each other—the larva of the *Diptera*, no doubt, preying upon the larva of the bee. In proof of this hypothesis, it may be stated that both specimens were brought to England from the coast of Africa—the bee from Sierra Leone, the bee-fly from Port Natal—and probably both will eventually be found in the same district. The last, the bee-fly, is at present an entomological novelty, and has not yet been named. The bee exhibits, in an unusual degree, a peculiarity common to many of the family, namely, a marked difference in the general aspect of the two sexes, the male being of a light tawny brown colour, and having a much longer body, a characteristic which generally distinguishes the female rather than the male. It would be interesting to know whether in the bee-fly, which bears so extraordinary a resemblance to this fine bee, an equal disparity of appearance exists between the two sexes; but, as we have at present only a solitary specimen of this insect, that is a point which cannot be decided; but other specimens will doubtless be captured, which may enable us to solve this interesting entomological problem.

In concluding my remarks on curious resemblances between "bees" and various kinds of two-winged "flies," I may mention a curious instance of resemblance between a dipterous insect and one of the wasp tribe (*Vespidæ*). *Eumenes esuriens*, a small Indian wasp, found in Bengal, has its counterpart (the resemblance being truly extraordinary) in *Cesia eumenoides*, the specific name of which has been conferred upon it in consequence of this singular resemblance. I ought also to mention, as a case in point not the least singular, that a British dipterous insect of the *Syrphus* tribe, belonging to the genus *Eristalis*, is so like the common hive-bee, that it would, at a glance, deceive any observer untrained as an entomologist.

G.

Extracts from Dr. Evans's Poem.

Most apiarian works of recent publication have contained a larger or smaller number of quotations from the above writer, who has been well termed the apiarian laureate. We have not in this edition made any change in the poetical extracts inserted by our author himself, but our strong predilection for "The Bees" of Dr. Evans renders us unwilling to let the book leave our hands without furnishing our readers with some opportunity of looking into its undeniable merits. The author was at one time a physician of Shrewsbury, but he subsequently removed into and died in Wales. His poem was in four parts, though only three of these appear ever to have been published; but in a presentation copy in the possession of Mr. A. Neighbour, to which we had access while engaged upon the revision of "The Apiary," there is a written memorandum stating that the fourth part existed in manuscript ready for the press in the possession of the family. On the strength of this we wrote letters of enquiry to more than one medical man, but wholly in vain. The gentleman known as "A Renfrewshire Bee-Keeper" was however engaged simultaneously in the same effort, and proves to have been more persevering and successful, though only in reaching the disappointing result, that the only survivor out of a family of eleven could simply give him no information at all. Should the lost part happily ever come to light it will prove a real treasure to apiarian literature; but we fear the idea is a hopeless one.*

Dr. Bevan cited a large number of passages from this poem, and many of these have been repeated by Mr. Langstroth and others. The present editor added several to those which were already given in Mr. Neighbour's work, and from the total of those now contained therein the following may prove an acceptable selection.

* The carelessness or ignorance which has allowed such a document to perish may suggest to some of us a reflection such as this:—

Degenerate scions of the gifted sire!
His "words that burn" they thought should *light the fire.*

The first is a description of the monarch of the hive—overdrawn of course to our ideas, and indeed fictitious, but admirable according to the information of the poet's own day:—

"But mark, of regal port and awful mien,
Where moves with measured pace the insect queen!
Twelve chosen guards, with slow and solemn gait,
Bend at her nod, and round her person wait.
Not eastern despots, of their splendour vain,
Can boast, in all their pomp, a brighter train
Of fear-bound satraps; not in bonds of love
Can loyal Britons more obedient move."

Next we have the drones:—

"But now, when April smiles through many a tear,
And the bright Bull receives the rolling year,
Another tribe, to different fates assigned,
In ampler cells their giant limbs confined,
Burst through the yielding wax, and wheel around
On heavier wing, and hum a deeper sound.
No sharpened sting they boast; yet, buzzing loud,
Before the hive, in threatening circles, crowd
The unwieldy drones. Their short proboscis sips
No luscious nectar from the wild thyme's lips;
From the lime's leaf no amber drops they steal,
Nor bear their grooveless thighs the foodful meal:
On others' toils, in pampered leisure, thrive
The lazy fathers of the industrious hive."

But far better than either of these, and rising to an altogether higher level of poetry, is the following beautiful apostrophe to the working bees:—

"Ye light-winged labourers! hail the auspicious sign,
When the twin stars in rival splendour shine!
Cheered by their beams, your quickening numbers swell,
And pant your nations in the crowded cell.
Blithe Maia calls, and bids her jocund train
Breathe the warm gale, or softly falling rain;

Inhaled at every pore, the dewy flood
Spreads the young leaf, and wakes the sleeping bud.
* * * * * *
Yes, light-winged labourers! still unwearied range
From flower to flower, your only love of change!
Still be your envied lot, communion rare,
To wreathe contentment round the brow of care!
No nice distinctions, or of rich or great,
Shade the clear sunshine of your peaceful state;
Nor Avarice there unfolds her dragon wing,
Nor racked Ambition feels the scorpion sting;
Your tempered wants an easy wealth dispense,
The public store your only affluence:
For all alike the busy fervour glows,
Alike ye labour, and alike repose;*
Free as the air, yet in strict order joined,
Unnumbered bodies with a single mind.
One royal head, with ever-watchful eye,
Reins and directs your restless industry,
Builds on your love her firm-cemented throne,
And with her people's safety seals her own."

What again can be happier, and at the same time more scientifically true, than the following lines on the system by which bees rifle the flowers, but bestow upon them in return the means to a fresh development and beauty?—

"And plains sad Chloris how these spoilers steal
From her ripe crests the vivifying meal,
Pare the thin films that shield her anthered reign,
And all her nectared cells insatiate drain?
No! kind intruders; all reserved for you
She pours through honeyed horn her luscious dew,
While, grateful for the rich repast, ye shed
Fresh showers prolific round her genial bed."

Then we have a description of a colony of bees just on the point of starting for a swarm:—

* "Omnibus una quies operum, labor omnibus unus."—*Virgil*, G. iv. 184.

"See where, with hurried step, the impassioned throng
Pace o'er the hive, and seem, with plaintive song,
To invite their loitering queen; now range the floor,
And hang in clustered columns from the door;
Or now in restless rings around they fly,
Nor spoil they sip, nor load the hollowed thigh;
E'en the dull drone his wonted ease gives o'er,
Flaps the unwieldy wing, and longs to soar."

Presently the hesitation is over:—

"Mounts the glad chief! and, to the cheated eye,
Ten thousand shuttles dart along the sky,
As swift through ether rise the rushing swarms,
Gay dancing to the beam their sun-bright forms,
And each thin form, still lingering on the sight,
Trails, as it shoots, a line of silver light.
* * * * * * *
High poised on buoyant wing, the thoughtful queen
In gaze attentive views the varied scene,
And soon her far-stretched ken discerns below
The light laburnum lift her polished brow,
Wave her green leafy ringlets o'er the glade,
And seem to beckon to her friendly shade.
Swift as the falcon's sweep, the monarch bends
Her flight abrupt: the following host descends;
Round the fine twig, like clustered grapes, they close
In thickening wreaths, and court a short repose."

Next we are presented with a detailed account of the process of comb-building, in the course of which Dr. Evans strikingly exhibits his power of describing the common-place in language which is never for an instant common-place itself—a power in which he has certainly never been surpassed, and scarcely equalled, unless by Pope, who apparently was his model:—

"So, filtered through yon flutterer's folded mail,
Clings the cooled wax, and hardens to a scale.
Swift, at her well-known call, the ready train
(For not a buzz boon Nature breathes in vain)

Spring to each falling flake, and bear along
Their glossy burdens to the builder throng.
* * * * * * *
These in firm phalanx ply their twinkling feet,
Stretch out the ductile mass, and form the street,
With many a cross-way path and postern gate,
That shorten to their range the spreading state.
Those with sharp sickle, or with sharper tooth,
Pare each excrescence, and each angle smooth;
Till now, in finished pride, two radiant rows
Of snow-white cells one mutual base disclose.
Six shining panels gird each polished round,
The door's fine rim with waxen fillet bound,
While walls so thin, with sister walls combined,
Weak in themselves, a sure dependence find."

This precise exposition of facts may conduct us to the following reflections upon the whole subject of the marvels of insect mechanism, and with them the present volume may a second time appropriately conclude:—

"On books deep poring, ye pale sons of toil,
Who waste in studious trance the midnight oil,
Say, can ye emulate, with all your rules.
Drawn or from Grecian or from Gothic schools,
This artless frame? Instinct her simple guide,
A heaven-taught insect baffles all your pride.
Or ye on theory's wild wave that roam,
And skim from science but its froth and foam,
Who wield 'gainst Truth the sharp yet shivery lance,
Devoted bending to your idol, Chance;
Oh! say, could Chance her lawless atoms bind,
And weave the tissued woof of sense and mind,
Or her blind impulse in yon mansions trace
The firmest fabric with the amplest space?
No! while ye boast to bow at Reason's shrine,
That Reason bids you hail the Power Divine.
Not huge Behemoth, not the whale's vast form,
That snouts a torrent and that breathes a storm.

Transcends in organs apt the puny fly,
Her fine-strung feelers, and her glanceful eye
Set with ten thousand lenses. Not the pile
By fabled giant raised in Erin's isle,
Not Staffa's crystalled shore, where now, Fingāl,
Roar the hoarse surges through thy columned hall,
Nor all yon marshalled orbs that ride so high,
Proclaim more loud a present Deity,
Than the nice symmetry of these small cells,
Where on each angle genuine Science dwells,
And joys to mark through wide creation's reign
How close the lessening links of her continued chain."

INDEX.

*** To enable this index to be of real practical value, without being unnecessarily bulky, its sub-headings seldom include items which occur under a *section* denoted by the principal heading, and to which the mark § after the figure calls attention. Thus "Queen Bee 4§" implies that an entire section on the subject of the queen will be found at page 4, whilst the entries which follow have reference to incidental allusions in other portions of the work. Many, however, of the items contained in that section, and strictly referring to the queen, will be found under some *other* heading, *e.g.*, Eggs, Sting, Royal Cells.

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Zinc—see Covers, Perforated zinc, Slides, Suspenders, Ventilators.

Post Script.—While this sheet is in the press a paragraph has appeared in the papers ("Daily News," June 3) announcing the introduction of a large number of *Cyprian and Syrian bees* into this country. The importer is Mr. D. A. Jones, of Beeton, Ontario, who at the date mentioned was exhibiting his insects at the London offices of Messrs. Thurber, in Cannon Street. He speaks of the Syrian or Holy Land bee as a race of especial value, noting particularly the long distances to which they will travel, the great speed of their flight, and the surprising loads which they are capable of bearing home. Will they prove identical with the Smyrnaean bees?

CORRECTIONS.

Pp. 98, line 13, and 143, last line, *for* phrail *read* frail.
P. 106, line 5, *for* is a contributor *read* was formerly a contributor.
P. 118, line 7 from bottom, *for* His maker is, &c., *read* Mr. Lee of Bagshot makes his inventions, but they are open to others besides.
P. 170, last line, *add* See page 202.
P. 189, line 8, *delete* and "Nadiring Stocks."